"Efficacy of Simplified Acute Physiological Scoring II in predicting the Mortality and Morbidity in Perforation Peritonitis"

Dissertation submitted to

The Tamil Nadu M.G.R Medical University

Chennai- 600032

In partial fulfilment of the

Regulations of the award of degree of

M.S. General Surgery

Department of General Surgery

Coimbatore Medical College Hospital

Coimbatore - 641018

CERTIFICATE

This is to certify that this dissertation titled ***"Efficacy of Simplified Acute Physiological Scoring II in predicting the Mortality and Morbidity in Perforation Peritonitis"*** submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the requirement for the award of M.S Degree Branch - I (General Surgery) is a bonafide work done by **Dr. Adarsh G**., post graduate student in General Surgery under my direct supervision and guidance during the period of September 2011 to November 2012.

Prof. G. Ravindran, M.S.
Associate Professor
Dept of General Surgery
Coimbatore Medical College Hospital

Prof. P.V. Vasantha Kumar, M.S.
Professor and Head of the Department
Dept. of general Surgery
Coimbatore Medical College Hospital

Dr. Vimala, M.D.
Dean,
Coimbatore Medical College Hospital

ACKNOWLEDGEMENT

It gives me immense pleasure to express my deep sense of gratitude to my Unit Chief Prof. Dr. G. Ravindran, M.S. General Surgery, Department of General Surgery, Coimbatore Medical College Hospital, for his excellent guidance and valuable suggestions during the course of study and in preparation of this dissertation.

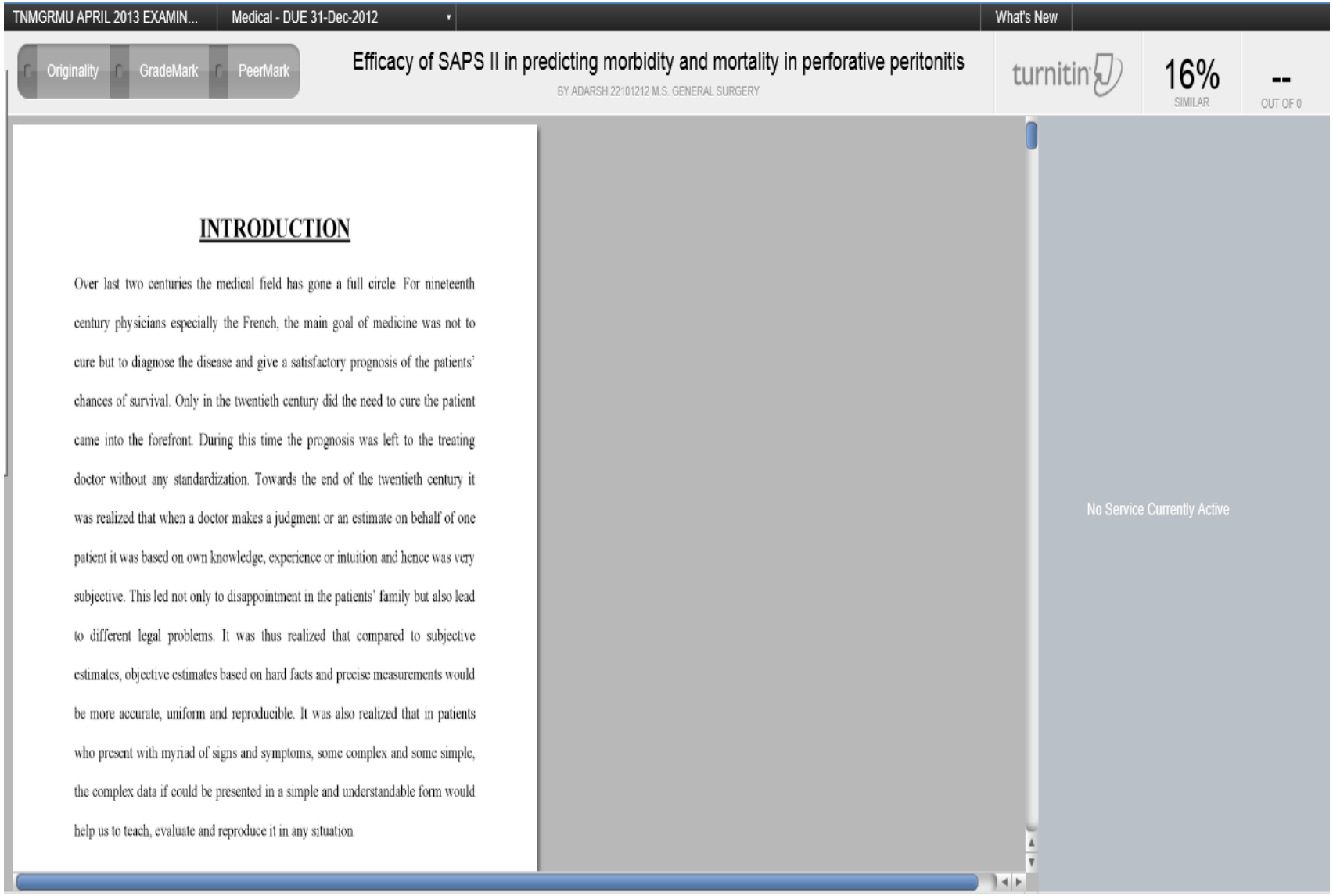
I am grateful to Prof. Dr. P.V.Vasantha Kumar, M.S., Professor and Head of the Department of General Surgery, Coimbatore Medical College Hospital , for his guidance throughout this study. I also express my heartfelt thanks for the associate professors of the college, Dr. Elango, Dr. Swaminathan, Dr. Ranganathan, Dr. Natarajan, and Dr. Saradha for their suggestions at the apt time that has helped me in the completion of this work.

I am grateful to my Assistant Professors, Dr. G. Vishwanathan, M.S., Dr. Muthulaxmi, M.S., for their help and guidance throughout this study.

I express my gratitude to Dr.Vimala., Dean, Coimbatore Medical College Hospital for permitting me to use the clinical material for the study.

I express my thanks to my friends and all others who have helped me in the preparation of this dissertation.

Last but not the least; I heartily thank all the patients for their kind support without whom this study could never have been done.



Originality Report from Turnitin

DECLARATION

I hereby declare that the dissertation entitled ***"Efficacy of Simplified Acute Physiological Scoring II in predicting the Mortality and Morbidity in Perforation Peritonitis"*** was done by me at Coimbatore Medical College Hospital Coimbatore – 641018 during the period of my post graduate study for M.S. Degree Branch-1 (General Surgery) from 2010 to 2013.

This dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University in partial fulfilment of the University regulations for award of M.S., Degree in General Surgery.

Dr. Adarsh G.
Post Graduate Student
M.S. General Surgery
Coimbatore Medical College Hospital

CONTENTS

Sl No	Topic	Page No.
1	Introduction	1
2	Aim of the study	4
3	Review of Literature	5
4	Materials & Methods	46
5	Results	52
6	Discussion	76
7	Conclusion	81
8	Appendix-1	Porforma
9	Appendix-2	Bibliography
10	Appendix-3	Master Chart

Efficacy of Simplified Acute Physiological Scoring II in predicting mortality and morbidity in Perforation Peritonitis

Abstract:

Introduction: Perforation peritonitis is a very common cause of generalized peritonitis in India. Prognosis of the disease is often difficult and complex. Individual prognosis by treating doctors is subjective and often overstates the chance of survival. We hence intend to find out the performance of simplified acute physiological scoring II (SAPS II) in predicting the mortality and morbidity in patients having perforation peritonitis. SAPSII takes into account 13 physiological variables and presence of chronic illness like AIDS and malignancies in giving the prognosis of the patient in the first 24 hours of admission.

Aims: 1.To evaluate the value of SAPS II scoring in predicting the mortality and morbidity in patients suffering from perforation peritonitis. 2. To provide an objective prognostic system for patients with perforation peritonitis. 3. To provide a risk classification system for patients presenting with perforation peritonitis.

Results: We applied SAPS II score to 100 consecutive patients admitted in our hospital during the study period. 89 were males and 11 were females. We could divide our patients into three groups depending on their SAPS II score as, those having a score less than 20, those having a score of 21-40, and those having a score above 40. The group having a SAPS II score less than 20 had no mortality and lesser hospital stay and were classified as low risk group. Patients with SAPS II score 21-40 had a higher morbidity and mortality and were classified as moderate rick group and patients having SAPS II score more than 40 had maximum mortality and were classified as high risk group.

Conclusion: SAPS II score is a very good tool in predicting Mortality and morbidity in patients suffering from perforation peritonitis.

Keywords: Perforation, Peritonitis, SAPS II score, Prognosis, Classification

Efficacy of Simplified Acute Physiological Scoring II in predicting mortality and morbidity in Perforation Peritonitis

Abstract:

Introduction: Perforation peritonitis is a very common cause of generalized peritonitis in India. Prognosis of the disease is often difficult and complex. Individual prognosis by treating doctors is subjective and often overstates the chance of survival. We hence intend to find out the performance of simplified acute physiological scoring II (SAPS II) in predicting the mortality and morbidity in patients having perforation peritonitis. SAPSII takes into account 13 physiological variables and presence of chronic illness like AIDS and malignancies in giving the prognosis of the patient in the first 24 hours of admission.

Aims: 1.To evaluate the value of SAPS II scoring in predicting the mortality and morbidity in patients suffering from perforation peritonitis. 2. To provide an objective prognostic system for patients with perforation peritonitis. 3. To provide a risk classification system for patients presenting with perforation peritonitis.

Results: We applied SAPS II score to 100 consecutive patients admitted in our hospital during the study period. 89 were males and 11 were females. We could divide our patients into three groups depending on their SAPS II score as, those having a score less than 20, those having a score of 21-40, and those having a score above 40. The group having a SAPS II score less than 20 had no mortality and lesser hospital stay and were classified as low risk group. Patients with SAPS II score 21-40 had a higher morbidity and mortality and were classified as moderate rick group and patients having SAPS II score more than 40 had maximum mortality and were classified as high risk group.

Conclusion: SAPS II score is a very good tool in predicting Mortality and morbidity in patients suffering from perforation peritonitis.

Keywords: Perforation, Peritonitis, SAPS II score, Prognosis, Classification

INTRODUCTION

Over last two centuries the medical field has gone a full circle. For nineteenth century physicians especially the French, the main goal of medicine was not to cure but to diagnose the disease and give a satisfactory prognosis of the patients' chances of survival. Only in the twentieth century did the need to cure the patient came into the forefront. During this time the prognosis was left to the treating doctor without any standardization. Towards the end of the twentieth century it was realized that when a doctor makes a judgment or an estimate on behalf of one patient it was based on own knowledge, experience or intuition and hence was very subjective. This led to improper management and poor outcome in some of the patients. It was thus realized that compared to subjective estimates, objective estimates based on hard facts and precise measurements would be more accurate, uniform and reproducible. Patients present with myriad of signs and symptoms, some complex and some simple. The complex data if it could be presented in a simple, understandable and in an objective form would help us to teach, evaluate, review and reproduce it in any situation.

This led to the development of scoring systems which tried to objectively predict the prognosis of the patient. These systems give the prognosis of the patients

taking into account the objective values of various physiological parameters of the patient and the presence of different chronic diseases in the patient.

The accurate predictive ability would make it possible to measure more precisely, the quality of intensive care and other new life-saving technologies. Precise prognosis or risk stratification before treatment would also enable clinical researchers to use observational studies to contrast the quality of care in various intensive care units (ICUs) and to identify those components of ICU structure that are linked to improved patient outcome.

Scoring and grading allows us to understand

1. The pattern of occurrence
2. The complicating or limiting factors, and
3. The various outcomes

Such information could lead to better clinical decision making that would help in assessing quality of care, identify the deficiencies, enhance patient satisfaction and guide the rational allocation of health care resources. These risk-adjusted comparisons can then be made between different surgeons and different hospitals spanning different geographical areas.

Perforation peritonitis is a common and serious surgical emergency. The famous escapologist Harris Houdini escaped so many chains and locks but could not

escape from perforation peritonitis due to which he died following a blunt injury abdomen.

Perforation of hollow viscus is one of the most important etiological factors in causing peritonitis in developing countries. Management of perforation continues to be highly demanding, difficult and complex.

The etiological spectrum of peritonitis in Asia is different from that of western countries and there is paucity of data from India regarding its prognostic indicators, mortality and morbidity patterns.

Thus there is a need to properly prognosticate the condition and predict the mortality and morbidity patterns.

Most of the cases of perforation peritonitis present to peripheral hospitals where there is a lack of advanced investigative modalities.

There is a need to validate a scoring system which predicts the prognosis of the patient with minimal investigative modalities.

Simplified acute physiological scoring system II is prognostic system based on different clinical parameters, physiological parameters and also some basic investigations recorded within 24 hours of the patients' admission. It has been used in different ICU setups in the western countries for patients with different diagnosis. We intend to apply this scoring system in perforation peritonitis and test its efficacy in predicting morbidity and mortality in these patients.

OBJECTIVES OF THE STUDY

- To evaluate the value of SAPS II scoring in predicting the mortality and morbidity in patients suffering from perforation peritonitis
- To provide an objective prognostic system for patients with perforation peritonitis
- To provide a risk classification system for patients presenting with perforation peritonitis

REVIEW OF LITERATURE

ANATOMY OF THE PERITONIUM [1, 2, 3]

Peritoneum has 2 layers. Peritoneal cavity is lined by parietal peritoneum and the intra abdominal organs are covered by visceral peritoneum.

Together its surface area roughly corresponds to the body cutaneous surface area.

Peritoneum consists of a single layer of flattened cells, mesothelium, overlying areolar tissue which varies in density in different regions. Over expansile parts this areolar tissue is loose (eg. Transversalis fascia) whereas in nonexpansile regions it is quite thick (eg. Ileac fascia). Irrespective of the nature these form the layer between the parietal peritoneum and abdominal wall.

Various folds of peritoneum cover the intra abdominal organs and connect the viscera to the abdominal wall or one another. These folds form the mesentry of the bowel as well as various intraperitonial ligaments. The fold of peritoneum between the stomach and the transverse colon forms the greater omentum which acts as a policeman of the peritoneal cavity; its functions are described later.

Peritoneum is a semipermeable membrane allowing exchange of fluids between cavity and the blood.

Usually there is only about 50 ml of peritoneal fluid which is a transudate with following characteristics.

- Specific gravity below 0.016;
- protein concentration below 3g/dl;
- white blood cell count below 3000/µL;
- complement mediated antibacterial activity; and

There will be no fibrinogen related clotting inside the peritoneal cavity.

The circulation of peritoneal fluid is directed towards the sub diaphragmatic lymphatics.

PERITONIAL DEFENCE MECHANISMS

Peritoneal cavity is normally sterile.

Peritonitis ensues if peritoneal defense mechanisms are overwhelmed by massive or continuous contamination.

Bacterial contamination causes release of many bacterial liposaccharides. These cause increased expression of tumor necrosis factor (TNF).

Increased TNF causes increased expression of plasminogen activator inhibitor, thus resulting in decreased plasminogen and persistence of fibrin.

Fibrin clots segregate bacterial deposits, thus reducing the source of endotoxins that contribute to sepsis, but this may inadvertently shield the bacteria from the body defense mechanisms.

Role of omentum in peritonitis is well established.

It helps in

- sealing off a leaking viscus (eg, a perforated ulcer) or an area of infection (eg, appendicitis)
- Carrying collateral blood supply to ischemic viscera.
- It also helps in bacterial scavenging function by absorption of small particles
- Delivery of phagocytes that destroy bacteria.

ACUTE SECONDARY BACTERIAL PERITONITIS [3, 4, 5]

Pathophysiology

Peritonitis is an inflammatory or suppurative response of peritoneal lining due to direct irritation.

Secondary peritonitis occurs due to bacterial contamination originating from within the viscera or from external sources (eg, penetrating injuries).

It most often follows disruption of hollow viscus.

The extravasated fluids are often sterile but will provoke a vigorous inflammatory response once they get infected which is due to bacterial migration.

Gastric juice from a perforated duodenal ulcer remains mostly sterile for several hours, during which time it produces a chemical peritonitis with large fluid losses;

but if left untreated it evolves within 6-12 hours into bacterial peritonitis. Intraperitonial fluid dilutes opsonic proteins and impairs phagocytosis.

When hemoglobin gets collected in peritoneal cavity, *Escherichia.coli* growing within the cavity can elaborate leucotoxins that reduce bactericidal activity. Continued contamination leads to generalized peritonitis and eventually to septicemia and multi organ failure. Common causes of peritonitis are illustrated in the following table.

Causes	**Mortality rate**
Appendicitis	<10%
Perforated gastroduodenal ulcers	
Acute salpingitis	
Diverticulitis (localized perforation)	<20%
Non vascular small bowel perforation	
Gangrenous cholecystitis	
Multiple trauma	
Large bowel perforations	20-80%
Ischemic bowel disease	
Acute necrotizing pancreatitis	
Postoperative complications	

Factors influencing the severity of peritonitis include the

- Amount of contamination,
- Duration and nature of injury, and
- Host factors.

Causative organisms

Systemic sepsis in peritonitis depends on the

- virulence of the causative organism
- the bacterial load
- duration of bacterial proliferation
- synergistic interaction between the bacteria

Most peritonitis is caused by poly microbial infection.

Cultures usually contain mixture of aerobic and anaerobic organisms.

This usually mimics the microbial contents of the organ involved.

Proximal bowel perforations usually show gram positive organisms.

As it goes to distal bowel there will be more of gram negative and anaerobic organisms.

Predominant aerobic pathogens include

- E.coli,

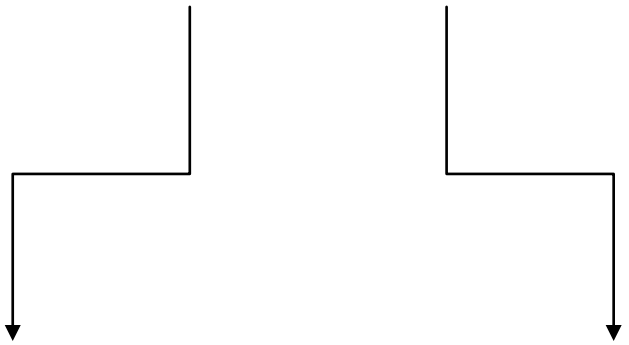
- Streptococci,
- Proteus, and
- The Enterobacter-Klebsiella groups.

The anaerobic group is dominated by

- Bacteroides fragilis,
- Anaerobic cocci, and
- Clostridia.

Any synergism between anaerobic and anaerobic organisms increases the severity of the peritonitis.

Causative organism in Perforation peritonitis



Upper GI Tract	**Lower GI Tract**
- **Streptococci**	**- Bacteroides fragilis**
- **E. coli**	**- Anaerobic cocci**
- **Klebsciella**	**- Clostridia**
- **Enterobacter**	

Clinical findings

By estimating the severity of the peritonitis from clinical and laboratory findings, the need for specific treatment and surgery can be determined.

Clinical features reflect the duration and severity of peritonitis.

Age and general health of the patient bear considerably on the outcome of the disease.

Usual presentation is like an acute abdomen.

Local findings include

1. abdominal pain,
2. tenderness,
3. guarding and rigidity,
4. distension,
5. free air in abdomen,
6. free fluid in abdomen
7. Diminished bowel sounds.

Systemic findings include

1. fever
2. chills or rigors
3. tachycardia
4. tachypnoea

5. restlessness
6. dehydration
7. oliguria
8. disorientation
9. refractive shock

Shock is due to combined effect of hypovolemia and septicemia with multi organ dysfunction.

These signs are difficult to interpret in

- Very young
- Very old, and
- In patients who are chronically debilitated or immunosuppressed.

Hence high index of suspicion is required to diagnose peritonitis in these patients

Radiological investigations

These are x-ray, CT scan, and ultrasonogram

The features which may point at peritonitis are

- Free air below diaphragm
- There may be free fluid in pelvic cavity and Morrison's pouch,
- Dilated bowel loops and absent peristalsis,
- Sometimes it can show the organ involved in the pathology (eg, pancreatitis)

Laboratory investigations

These help to gauge the severity of peritonitis and guide therapy.

Blood studies should include

- Complete blood cell count,
- Arterial blood gas,
- Electrolytes,
- Liver and renal function tests.

Samples for culture for blood, urine, sputum, and peritoneal fluid should be taken before starting of antibiotics.

Differential Diagnosis

- Specific types of infective peritonitis can be seen (eg, gonococci, Candida).
- In elderly systemic diseases (eg, pneumonia, uremia) can produce intestinal ileus so striking that it may resemble peritonitis or bowel obstruction.
- Familial Mediterranean fever (periodic peritonitis, familial paroxysmal poly serositis)
    - rare genetic condition that affects individuals of Mediterranean genetic background.
    - Its cause is unknown.
    - Patients have recurrent episodes of abdominal pain with pleuritic and joint pains.
    - Fever and leukocytois are common.
    - Colchicines prevent but do not treat the acute attacks.
    - Laparoscopy is preferred over laparotomy in suspected individuals.
    - Free fluid and inflammation is found but cultures are negative.
    - Appendicectomy should be done to simplify the diagnosis.

Treatment of Peritonitis

The mainstay of treatment of peritonitis is

- Fluid and electrolyte replacement,
- operative control of sepsis, and
- systemic antibiotics

Pre Operative Care

Intravenous fluids:

The massive transfer of fluids into the peritoneal cavity should be replaced by an appropriate amount of intravenous fluid.

If systemic toxicity is evident or if the patient is old or in fragile health, a central venous line should be started for the purpose of

- Monitoring the central venous pressure as well as
- Infusion of adequate amount of fluids.

A bladder catheter introduced for monitoring the urine output.

Serial body weight measurements are done to monitor fluid requirements.

Ringer lactate or balanced solution is infused rapidly to correct intravascular hypovolemia and to maintain urine output.

Blood may be required in patients who are anemic or in those who have concomitant bleeding.

In advanced septicemia inotropics and mechanical ventilation may be necessary and should be provided in an intensive care setup.

Antibiotics:

Loading doses of intravenous antibiotics should be given directed against the anticipated pathogen after the samples for culture and sensitivity are taken.

Initial antibiotics employed are usually

- third generation cephalosporins,
- ampicillin-sulbactam,
- ticarcillin-clavulinic acid,
- aztreonam or imipenem-cilastatin for gram negative coliforms and
- metronidazole or clindamycin for anaerobic organisms.

Inadequate drug dosing in the initial period may contribute for treatment failure. Aminoglycosides should be used with care because of the fear for renal effects associated with their use.

Antibiotics should be modified postoperatively according to culture and sensitivity patterns.

Antibiotics are continued till the patient is afebrile and a differential count of less than 3% band forms are achieved.

Operative Management

Control of sepsis:

The surgery should be aimed at

- removing all the infective material,
- correct the underlying cause, and
- prevent late complications.

A midline incision offers the best surgical exposure.

A thorough laparotomy is performed and all the necrotic and infective materials should be removed.

Special attention should be given to peritoneal recesses where there is a chance of localized infections.

Adequate samples for cultures are taken and sent for sensitivity tests.

Primary disease is then treated for example closure of a perforation, resection and anastomosis if the diseased segment is large, appendicectomy in case of ruptured appendix.

Peritoneal lavage:

A peritoneal wash is usually warranted in diffuse peritonitis.

Copious amounts of warm isotonic crystalloid solutions are used

- To remove gross particulate matter as well as blood and

- Fibrin clots and
- Dilute the bacterial load.

Inclusion of antibiotics and antiseptics to the irrigating solutions is generally useless or even harmful as they may cause adhesions.

Antibiotics given parenterally usually attain bactericidal levels in the peritoneal fluid thus adding them to lavage fluid will be unnecessary.

After lavage the remaining fluid should be aspirated completely as it may later dilute the opsonins and hamper the defense mechanisms.

Peritoneal Drainage:

Drainage of free peritoneal cavity is controversial as

- There is a chance of introduction of more infection,
- The drains are sealed off early and
- may predispose to abscess and fistula formation.

When used, closed drains with continuous suction should be used.

Surgical techniques

Gastroduodenal Perforation

Perforations of stomach are most commonly due to, either a gastric ulcer perforation or a malignant perforation. When the cause of perforation is an inflammatory process the management depends on the size of perforation. A small

perforation usually primarily closed and covered with a live omental patch placed over it. A larger perforation may need a bypass procedure like a gastrojejunostomy included in the management.

Management of a malignant perforation depends on the resectability of the tumor and also on the patient condition. If the tumor is resectable and the patient can tolerate the surgery then a gastrectomy with either of the Billroth anastomoses can be used. If the tumor is not resectable and the patient is in debilitated condition then a closure of perforation and an adjunct bypass procedure of gastrojejunostomy can be done. For these patients reassessment of the tumor and re-surgery or chemotherapy should be planned.

Small bowel perforations

Small perforations include the jejunal and ileal perforations. The jejunal perforations are usually caused due to penetrating injuries to the abdomen. Less commonly it may be due to inflammatory pathology like diverticular diseases, chrohn’s disease etc. Ileal perforation may be due to trauma, tuberculosis, typhoid or other inflammatory disorders. The management of small bowel perforations is mainly based on the size of perforation or number of perforations or on co existing strictures. If there is a solitary perforation and it is less than a third of the bowel circumference then a primary closure in horizontal axis is done. When the size of

perforation is larger or there are multiple perforations or they are associated with strictures then resection and anastomosis of the diseased bowel is indicated.

Large Bowel Perforations

Large bowel perforations are mainly due to trauma, malignancy of inflammatory bowel disorders. They are usually difficult to treat and have a high morbidity and mortality. The management is individualized and depends on the presentation. Traumatic perforations are usually treated with primary closure and a proximal loop colostomy. When it is due to a tumor which is resectable then resection of the tumor followed by anastomosis of the ends is attempted. This anastomosis should be protected by a proximal loop colostomy. Unresectable tumors may be treated with loop or end colostomy with perforation closure. When the perforation is due to inflammatory bowel disorders we may have to go with primary closure or the patient may need extensive resection of the involved large bowel which may extend to become a total proctocolectomy. But the patient in an emergency set up may not tolerate extensive procedures and we may have to do a diversion procedure initially followed by relook surgery once the patients' general condition improves.

Post operative care

Intensive care with ventilatory support may be necessary especially for unstable and frail patients.

Achieving hemodynamic stability and perfusing major organs is the immediate objective. Inotropics may be used for this purpose.

Antibiotics are given for 10-14 days depending on the severity of peritonitis.

A favorable response is shown by

- Adequate perfusion
- Good urine output,
- Reduced fever and leukocytosis,
- Resolution of ileus, and
- Returning of sense of wellbeing.

Early removal of non essential catheters is recommended.

Early enteral feeding is advised which has the advantage of improving the sense of wellbeing as well as restore the gut flora.

Complications

Post operative complications are frequent and can be divided into local and systemic complications.

Local complications are

- Deep wound infections,
- Residual abscesses and

- Intraperitonial sepsis,
- Anastomotic breakdown, and
- Fistula formation

These usually manifest by first week.

Persistent fever, hypotension, generalized edema, abdominal distension, prolonged mental apathy may be the sole indicators of persistent intra abdominal sepsis.

Uncontrolled sepsis leads to multi organ failure and ultimately death of the patient.

Prognosis

Overall mortality of generalized peritonitis is about 40%. Factors contributing to mortality will be studied in detail in our study through the SAPS II scoring.

REVIEW OF THE DIFFERENT SCORING SYSTEM

Different scoring systems have been developed over the years to try to accurately predict mortality and morbidity in patients requiring emergency surgical and medical care.

THE APACHE SYSTEM:

In 1981, Knaus and others proposed a scoring system to be used for

Classifying patients admitted to intensive care units [6]. It consisted of two parts:

1. A physiology score representing the degree of severity of acute illness

(Acute Physiology Score)

2. A preadmission health evaluation indicating a patient's health status

before the acute illness.

The Acute Physiological Scoring system was developed using a panel of multidisciplinary physicians who selected laboratory and clinical measurements important in predicting mortality [7].

The selection of the physiological variables was based on their easy availability at or shortly after admission to an ICU.

Relative weights of importance were assigned to each variable so that each variable was weighted on the basis of its relative importance compared with

all the other measurements.

Each researcher in the group was free to suggest additions or deletions of variables included on an initial list.

Finally , the panel agreed on a list of 34 physiological measurements, and relative weights of importance were assigned on a scale from 0 to 4.

The weights are neither symmetrical around the normal range nor uniform across different physiological measures.

In the original APACHE system,

- The greatest degree of abnormality for each variable was recorded in the first 32 hours of admission.
- Score was given to the variables and APACHE score was given to each patient

The original Acute physiological score for a patient was the total points for all 34 variables.

The second part of the original APACHE was the health questionnaire

that assessed health status before admission. On the basis of answers to

questions regarding

1) Number of recent visits to a physician,

2) Work status,

3) Activities of daily living and

4) Presence of carcinoma.

A patient was given a pre- ICU admission classification ranging from `A` for excellent health and `D` for severe failing health. The end result of APACHE was a separate APS and chronic disease classification for each patient. (E.g.: 14D, 16C etc.) [8]

THE APACHE II SYSTEM:

The APACHE II system is a revised version of the original APACHE and was published in1985.

The number of physiologic measurements was reduced from the original 34 to 12. Infrequently measured physiologic variables such as serum osmolarity, lactic acid level, and the skin testing for anergy were deleted, so were potentially redundant variables.

Each variable was deleted based upon clinical judgement and then evaluated using a multivariate comparison of the original APACHE system with each proposed revision, the total R2 and the correct classification rate for hospital mortality was used standards.

The smallest number of variables that reflected physiologic derangement for all vital organ systems as well as maintained statistical precision was 12.

Age and severe chronic health problems reflect diminished physiologic reserve and hence they have been directly incorporated into APACHE II.

Chronologic age is a well-documented risk factor for death from acute illness that is independent of the severity of disease.

During the validation, it was found that three of the four chronic health classifications (B, C, and D) were associated with higher death rates, when age and acute physiologic derangement were controlled.

However, only the most severe chronic organ system insufficiency or immunocompromised state (Class D) markedly influenced outcome.

It was also discovered that non-operative and emergency surgery admissions had a substantially higher risk for death from their prior organ system insufficiency than elective surgical admissions.

This was probably because patients with the most severe chronic conditions were not considered to be candidates for elective surgery.

Therefore non- operative or emergency operative admissions with a severe chronic organ system dysfunction were given an additional five points, while similar elective surgical admissions were given only two points. The maximum possible APACHE II score is 719 [(9)].

The problem with APACHE system is that it uses many investigative modalities which may be out of reach for a common man.

Thus there was a need for simplification of the system without altering its efficiency in predicting the outcome. SAPS is the system which was brought out as simplified APACHE.

SEPSIS SCORE:

It was developed by Elebute and Stober in 1983.

This system divides the clinical features of the septic state into four classes to which they ascribed a subjective degree of severity on an analogue scale. The attributes were

1) Local effects of tissue infection,

2) Degree of temperature elevation,

3) Secondary effects of sepsis and

4) Laboratory data.

The possible range of scores under this system is 0 to at least 45, depending on how the tables are interpreted. This system has been examined in detail by Dominioni and associates.

They reported on 135 patients with broad variety of infectious problems, including peritonitis, pneumonia, wound infection, urinary tract infection, abscess, septicemia and mediastinitis.

The sepsis scores ranged from 10 to greater than 30.

In a group of patients with an overall mortality rate of 56%, they observed deaths of 13 of 64 patients (20%) with scores of 20 or below and 63 of 71(89%) with scores greater than 20. If a score of 20 is arbitrarily chosen as a point above which death is predicted, the overall accuracy for this prediction will be 114 of 135 (84%).

THE MANHEIM PERITONITIS INDEX [6, 4, 6]:

Wacha and co-workers developed this index which incorporates information regarding

- age,
- gender,
- organ failure,
- cancer,
- duration of peritonitis,
- involvement of the colon,
- extent of spread within the peritoneum and
- the character of the peritoneal fluid

The possible scores range from 0 to 47, and patients with score above 26 are defined as having peritonitis.

Billing et al evaluated the effectiveness of this system in a multicenter study involving 2003 patients. The overall mortality was 19.5%. The maximal score was

47. 522 patients had a score of >26 and a mortality rate of 55% which was significantly greater than the 7% mortality observed in the 1481 patients who had a score of < 26 [17].

PERITONITIS INDEX ALTONA:

Teichmann and associates, in a report concerning scheduled reoperation for diffuse peritonitis, referred to this index. In this study, they observed that mean peritonitis index for patients who died was 1. The index for patients who lived was 0.38 [4].

This index uses

- age,
- extent of infection,
- malignancy,
- cardiovascular risks, and
- leucopenia

POSSUM:

Physiological and Operative Severity Score for enUmeration of Mortality and morbidity (POSSUM) and its Portsmouth modification (P-POSSUM) were developed to provide risk-adjusted analysis in patients undergoing surgery.

It consists of two parts:

Physiological assessment:

It provides exponential score on 12 variables. The physiological variables are:

- age,
- cardiac signs,
- respiratory signs,
- systolic blood pressure,
- pulse,
- coma score,
- serum urea,
- sodium,
- potassium,
- hemoglobin,
- white cell count, and
- ECG changes

Operative severity:

- operative magnitude
- number of operations within 30 days
- blood loss and peritoneal contamination
- presence of malignancy
- timing of operation.

THE SIMPLIFIED ACUTE PHYSIOLOGICAL SCORE (SAPS) [18-24]:

This system was developed by Le Gall et al in 1984 as an independent attempt to simplify APACHE.

It was a European north American study undertaken from September 1991 through February 1992. The patients were enrolled from September 1991 through December 1991.

Totally 13152 patients were enrolled from 10 countries from different hospitals. Patients were followed up for 2 months and any patient remaining in hospital after February 28 1992 was dropped from the study.

All consecutive admissions, 18 year or older, to adult ICU in the participating hospitals were eligible for enrollment,

Patients excluded were

- burns,
- coronary care patients, and
- Cardiac surgery patients.

After data collection the validity of data was inspected by random checking, by a second person.

Data was collected for the first 24 hours of admission.

To develop the scoring the study population was divided

- 65% of patients were selected as developmental data set and
- 35% as validation data set.

For each variable LOWESS smoothening function was used to suggest ranges for each variable.

For assigning points for each variable, dummy variables were created and multiple logistic regression analysis was used and resultant coefficients of this analysis were used to assign the points to the ranges.

The points were multiplied by 10 and rounded off to the nearest integer.

Hosmer-Lemeshow goodness of fit test were performed on both developmental and validation sets to assess the performance of the system.

Expected outcome within each set of population was compared with actual outcome to assess the goodness of fit.

Out of 37 initial variables selected using multiple regression technique, 13 variables which individually affected the prognosis of the patient were selected. Variables and scores given to each variable are as follows.

Type of admission	Emergency surgery	8
	Medical	6
	Elective surgery	0

Chronic diseases	None	0
	Metastatic carcinoma	9
	Hematological malignancy	10
	AIDS	17

Glasgow coma scale	<6	26
	6-8	13
	9-10	7
	11-13	5
	14-15	0

Age	<40	0
	40-59	7
	60-69	12
	70-74	15
	75-80	16
	>80	18

Systolic blood pressure	<70	13
	70-99	5
	100-199	0
	>200	2

Heart rate	<40	11
	40-69	2
	70-119	0
	120-159	4
	>=160	7

Temperature	$<39^0$ C / $<102^0$ F	0
	$>39^0$ C/ $>102^0$ F	3

Urine output	<0.5L/24hr	11
	0.5L-0.999L/24hr	4
	>1L/24hr	0

Serum urea/ BUN	<0.6g/L or <28mg/dl	0
	0.6-1.79g/L or 28-83mg/dl	6
	>=1.8g/L or >=84mg/dl	10

WBC	<1000/mm^3	12
	1000-19000/mm^3	0
	>=20000/mm^3	3

Potassium	<3mEq/L	3
	3-4.9mEq/L	0
	>=5mEq/L	3

Sodium	>=145mEq/L	1
	125-144mEq/L	0
	<125mEq/L	5

Bicarbonate	<15mEq/L	6
	15-19mEq/L	3
	>=20mEq/L	0

Bilirubin	<4mg/dl	0
	4-5.9mg/dl	4
	>=6mg/dl	9

If MV or CPAP PaO_2/FIO_2(mm Hg)	<100	11
	100-199	9
	>=200	6

BUN- Blood Urea Nitrogen MV- Mechanical Ventilation

WBC- White Blood Cell count CPAP-Continuous Positive Airway Pressure

From these values the probable hospital mortality was predicted from the developmental set by deriving a formula.

It was found that distribution of SAPS was highly skewed.

Thus an integration of all the SAPS score was used.

Thus the equation had to accommodate SAPS II and In[SAPSII +1].

Using these logit was calculated as

Logit = -7.7631+{0.0737x(SAPSII)}+{0.9971xln[(SAPSII)+1]}

this logit was converted to hospital mortality was calculated using following equation

Predicted Mortality = $e^{(Logit)} / (1+e^{(Logit)})$

The Reviewer Observation Characteristics (ROC) curve was plotted for SAPS II was calculated and the area under ROC was found to be 0.88 (95% confidence interval).

The only problem with SAPS II scoring is that sedated patients cannot be given a score, as GCS cannot be calculated. Also neurological considerations are not taken into account. [17]

Comparisons have been made of the relative predicted accuracy of SAPS versus APACHE II, both in multidiagnostic data bases and within specific disease categories.

The results indicate that there is a measurable improvement in predictive accuracy, defined as percent area under a Receiver-Operator Characteristic curve, for APACHE II as compared with SAPS when the comparison was performed with multi diagnostic data.

However, when comparisons were made within a single diagnostic category virtually equal accuracy was observed. The difference between these results is explained by the differences in the systems. SAPSII produces probability estimates without use of specific diagnostic or chronic health variables, therefore comparisons between it and APACHE II (which does use both these additional variables) should favour APACHE II. Within a single diagnostic category, however the two systems perform equally in predictive accuracy. Thus SAPS II is a very powerful prognostic tool when we are dealing with a single diagnostic modality. SAPS II is also cheaper and more affordable when compared to the APACHE II.

Uses of the prognostic scoring systems

Prognostic scoring systems have proved to be useful in risk stratification of patients for clinical trials and in the assessment of the quality of care delivered in ICUs. It is likely that they will assist the decision process regarding ICU admission. The role they will ultimately have in individual patient care decisions remains to be determined

1. Clinical studies:

A central problem in conducting a clinical trial with acutely ill patients is the need to ensure that both the treatment and control groups are at an equivalent baseline risk of death or another important outcome.

Randomization is used to spread these risks evenly between the patients groups, but randomization can only ensure that patients are randomly distributed but their risks are not randomly distributed.

For example, in the evaluation of a new form of therapy for peritonitis, potential patients could range from a 19 year old with a rupture appendix to a 72 year old with emphysema and cancer of perforated colon.

Appropriate conclusions regarding the efficacy of a new peritonitis treatment could not be reached unless the patients and their accompanying risks were evenly distributed between treatment and control groups.

A prognostic scoring system permits investigators to stratify patients according to risk before randomization to ensure that risks are evenly distributed [8].

Schein et al in their study on emergency operations for perforated ulcers, divided their patients based on APACHE II score, into two groups – those with low risk (score < 10) and those with high risk (score >10). They found that the mortality rate in the low risk patients was only 8% whereas it was 33.3% in the patients with a score >1015. Similar stratification of patients was done in numerous other studies [9, 10, 11, 12].

2. **Quality of care measurement**:

At the costs of medical care, especially hospital care have increased, quality assessment has become a major priority for

- ICUs,
- Government hospitals, and
- Third party payers.

Adjusting mortality and complication rates for risks before treatment, however, is a sensitive way to assess a hospital's or an ICU's performance.

A suburban shock and trauma unit will have a far different patient population than an inner city ICU.

A prognostic scoring system that establishes a predicted mortality rate before treatment for an ICU on the basis of patient-by-patient measurement of risk will permit the ICUs to compare the predicted outcome to its observed outcome.

The difference between predicted and actual death rates is one direct measure of quality of care and this technique can also provide unique insights regarding the usefulness of specific treatments.

Michael Marsh et al in 1990, in a study conducted to assess prediction of mortality by using the SAPS II scoring system in ICUs, observed that the predicted risk for hospital death among non-operative patients in Rochester Methodist Hospital was significantly higher than the risk predicted at Saint Mary's Hospital [(13)].

Further evaluation revealed that both the groups of patients had similar mean ages. When the SAPS II scores were examined, they observed that the mean acute physiology score of the patients at Rochester Methodist Hospital was significantly higher than the score observed at Saint Mary's Hospital

Knaus and co-workers in 1982, in a study comparing the outcome of acutely ill patients treated in French and American ICUs, observed that for patients with severe gastrointestinal disorders, the French hospital death rate was significantly higher than the one predicted in American hospitals. Investigations into this discrepancy led to the conclusion that the disparity may have been due in part to a more aggressive surgical approach to acute pancreatitis in France [(14)].

3. **Allocation of Resource**:

An important issue for every ICU is in deciding which patients to admit. Because cost containment dominates health care policy, we would like to improve patient selection to ICU care.

An objective method to identify the relative risk of patients might be useful to support clinical judgment and to establish priorities for ICU admission during the periods of limited bed availability [(8)].

Yet another important issue is to determine which patients have 100% mortality and further aggressive therapy would be futile.

Borlase et al in their study conducted in 1990, suggested that an SAPS>25, a Glasgow coma score < 7 and a creatinine > 4.5 mg/dl were good predictors of mortality on the first day of ICU admission.

In considering the daily cost of predicted SICU non-survivors ($ 1500/day), if treatment had been stopped after10 days of aggressive therapy with no improvement, the potential savings would have reached almost $ 250,000 or 4% of the total cost for the 100 patients studied [15].

4. **Statistical versus clinical judgment**:

One of the interesting aspects of the uses of the scoring systems is a comparison of the expectations that physicians and patients have regarding their prognosis and how their clinical and personal assessments compare to probabilities produced by the application of prognostic scoring systems.

5. **Individual Patient care decisions**:

For many clinicians, the most important question regarding prognostic scoring system is how they can help with individual patient care decisions. Prognostic scoring systems will never be able to predict outcome with 100% specificity, but accurate risk estimates of death or complications at the 90 to 99% level could be useful.

Before clinicians actually integrate such risk estimates into their practice, however, they should consider the implications of a risk prediction for an individual patient.

The argument frequently used is that group statistics do not apply to single individuals.

Although individual patients do have unique features they also share many common features with previous patients and consideration of these common characteristics permits us to anticipate their response and predict their outcome. Moreover, if probabilities did not have a role in clinical decision-making, then we would never be able to use past experience to guide future decisions.

Prognostic scoring systems can assist us in ensuring that clinical predictions are well calibrated and accurate for a patient. Because they estimate a patient's potential to benefit from therapy, they are also estimating, in an unbiased manner, an individual's comparative entitlement to medical care [(8)].

In chronic duodenal ulcer patients, definitive surgery may be performed only if the SAPS II score was below 20, whereas those with higher scores may be subjected to simple closure. Likewise in patients with perforated gastric ulcers, closure or wedge excision of the ulcer may be used, if technically feasible; in the moderate and high-risk group (SAPS II score > 30). In the low-risk group (score <20), truncal vagotomy and antrectomy or partial gastrectomy may be performed for ulcers situated in the prepyloric region or the body respectively.

LIMITATIONS OF PROGNOSTIC SCORING SYSTEMS

The use of prognostic scoring systems for clinical decision-making raises many ethical, philosophical and practical issues.

The most important practical requirements are that its predictions must approach infallibility and it must be reproducible. The original SAPS II score used a single assessment on first day of ICU admission. While this had been shown to be an excellent method for stratifying patients into comparable risk groups for audits or clinical trials, it is inadequate for predicting individual prognosis for several theoretical and practical reasons.

1. It does not reflect the dynamic pathophysiological changes that occur during the patient's stay in the ICU.

2. Although the SAPS II score with the exception of GCS is based on objective data, derivation of risk of death is based on a subjective choice of a single specific diagnostic category or major organ system as the primary cause of ICU admission. The correct choice can sometimes be extremely difficult to make, especially among patients with multiple organ system failure and high mortality rates, precisely the group of patients in whom a correct prediction is important. An incorrect choice can lead to a wrong computation of risk of death and therefore, a wrong prediction.

3. Therefore, it would be unacceptable to clinicians, patients and relatives to base major clinical decisions on just one assessment [16].

But in the scoring systems like APACHE II, SAPS II where many clinical criteria are taken into consideration clinical decisions based on them may prove to be in sound judgement.

Because of these controversies there is a need for further research and analysis is to arrive at the ultimate goal of developing ideal and 100% reliable and affordable prognostic system.

DESIGN OF STUDY:

Prospective observational study

METHODOLOGY:

Study population:

- 100 consecutive patients presenting to surgical ward of Coimbatore medical college Hospital,
- with signs of perforation peritonitis like,
    - abdominal tenderness,
    - guarding,
    - rigidity,
    - rebound tenderness,
- x-ray showing air under diaphragm,
- aged 18yrs and above
- between September 2011 to November 2012.

Inclusion criteria:

- Patients with spontaneous perforation peritonitis
- Patients with isolated traumatic perforation peritonitis
- Aged 18years and above

Exclusion criteria:

- Patients who are below 18 years
- Peritonitis of any other cause
- Patients with traumatic perforation peritonitis associated with other organ injury

The SAPS II variables are collected for each patient. The data collection was done on the Performa attached in the annexure.

The data was then entered in to Microsoft excel sheet.

Data collection was done in all the patient preoperatively within 24hrs of admission, after informed oral consent.

Points were assigned to each patient based on SAPS II criteria.

SAPS mortality score calculated for each patient was based on formula:

Logit = -7.7631+{0.0737x(SAPSII)}+{0.9971xln[(SAPSII)+1]}

Predicted Mortality $=e^{(Logit)} / (1+e^{(Logit)})$

The patients were observed throughout their hospital stay. They were watched for their recovery as well as development of complications.

The total hospital stay was also calculated in the end which is a good indicator for the morbidity of the patient.

If the patient expired the cause of the demise was noted and added to the complications.

Then we compare this mortality score to the actual outcome of the patient regarding morbidity and mortality.

Morbidity definitions

Wound hematoma: It was defined as local hematoma requiring evacuation.

Deep hematoma: Postoperative bleeding occurring in intraperitonial plane requiring re-exploration.

Respiratory complications: A patient was said to have respiratory complication if he / she had

- Production of purulent sputum with positive bacteriological cultures,
- Chest radiological changes of consolidation or effusion.
- Unable to maintain saturation even with near normal blood pressure and hemoglobin.

Wound infection: Patient was said to have wound infection if there were signs of

- Wound cellulitis
- Discharge of purulent exudates from the wound
- Positive wound culture

Urinary tract infection(UTI): The diagnosis of UTI is made when a patient with preciously clear urine has

- symptoms of UTI like burning micturition , hematuria, pain abdomen radiating to loin
- Positive urine culture that is more than 10^3 colony forming units/ ml of urine, of known bacteria which can cause UTI.

Deep infection: This is defined by the presence of an intra-abdominal collection

- pelvic or
- sub diaphragmatic abscesses

confirmed clinically or radiologically.

Septicemia: Positive blood culture of pathological organism.

Wound dehiscence: Defined as either

- Superficial breakdown of wound not exposing bowel
- deep wound breakdown exposing the bowels

Impaired renal function: Arbitrarily defined as an increase in blood urea of more than 5 mmol / l from preoperative levels.

Hypotension: As indicated by fall in systolic blood pressure below 90 mmHg for more than 2 Hours as determined by sphygmomanometer measurement or arterial pressure transducer measurement.

Respiratory failure: Respiratory difficulty requiring emergency ventilation.

Enterocutaneous Fistula: Discharge of bowel content via the drain, wound or abnormal Orifice.

Relaparotomy: The requirement of a second surgery in the immediate post operative period due to any reason like intra abdominal abscess or enterocutaneous fistulas.

The patients were observed in the hospital till their discharge for the above mentioned complications.

The incidence of these complications, the total hospital stay and the mortality was recorded and statistics were made using the SAPSII scoring system.

The expected mortality is compared with the actual mortality and the scores are compared with the actual morbidity of the patients.

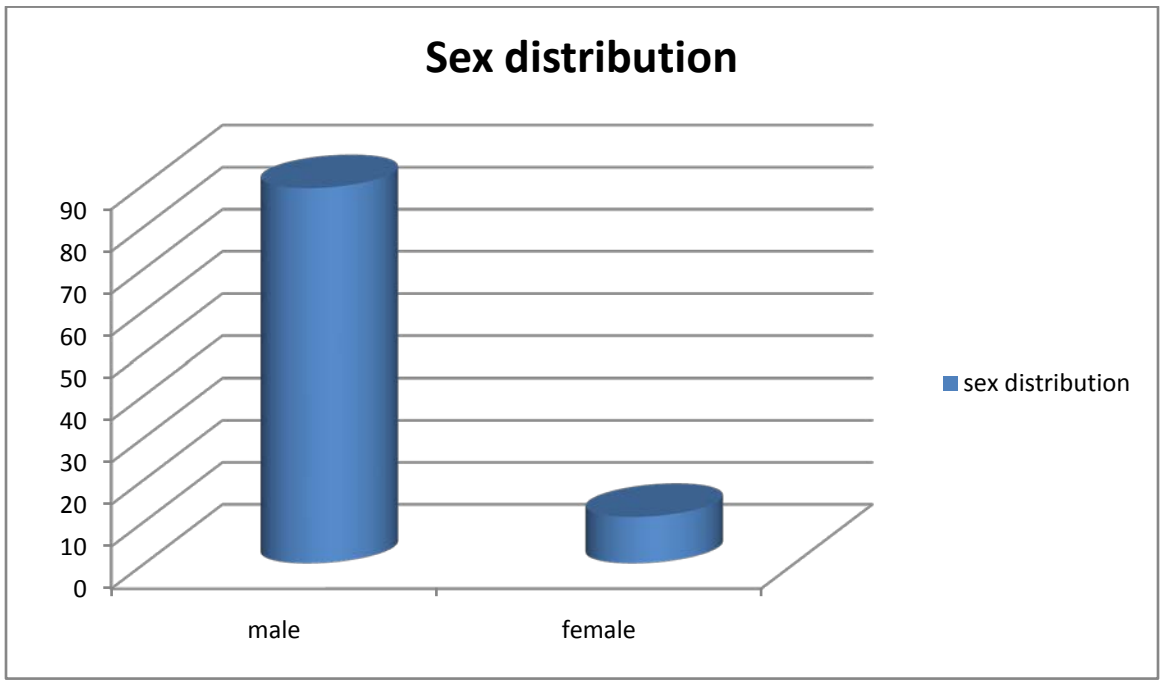
We intend to develop a mortality and morbidity classification system based on the SAPS II scoring as low, moderate and high risk groups.

Results

The SAPS II scoring was applied on 100 cases of perforation peritonitis. Of the 100 cases perforation was most common in males accounting for 89 cases while female cases were only 11.

Table 1. Sex distribution

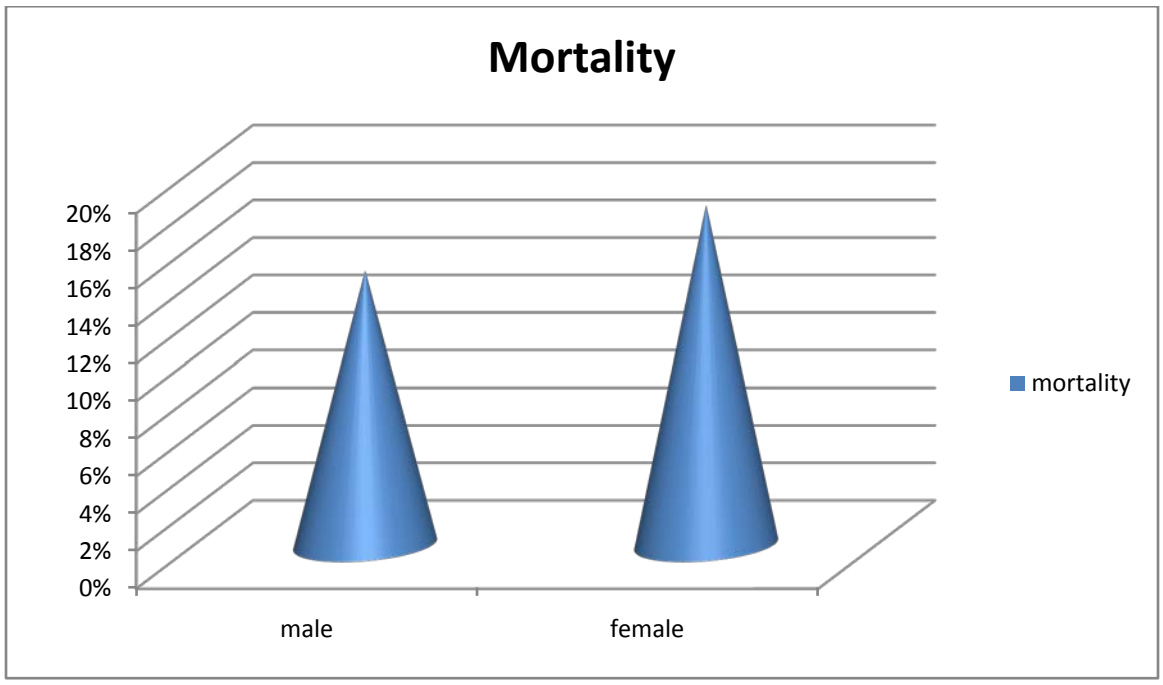
Males	Females	Total
89	11	100



Mortality

Mortality in the study group was found to be 15/100. 13 deaths were from male population. Females contributed 2 deaths.

	Males	Females
Death	13	2



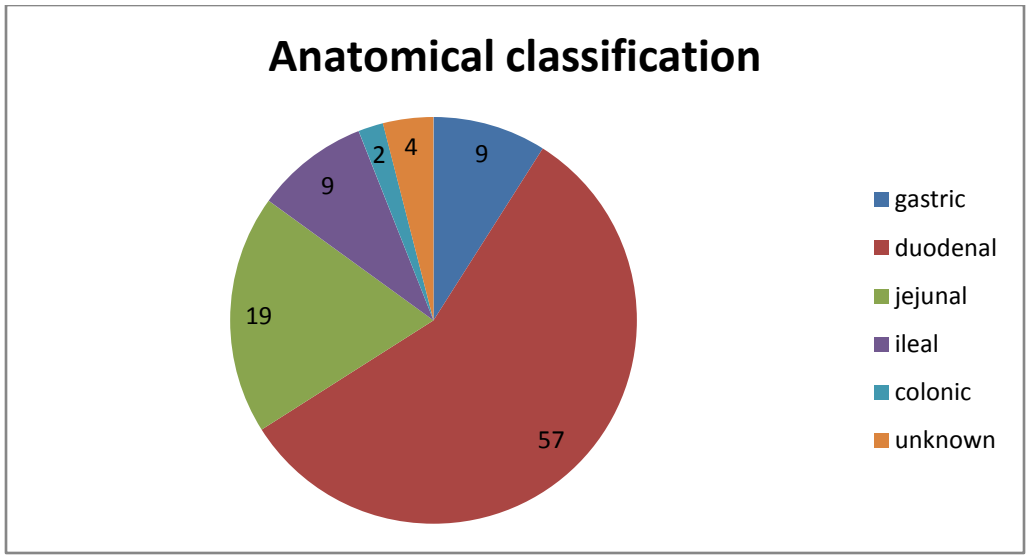
Mortality rate was found to be slightly higher in females.

Anatomical classification.

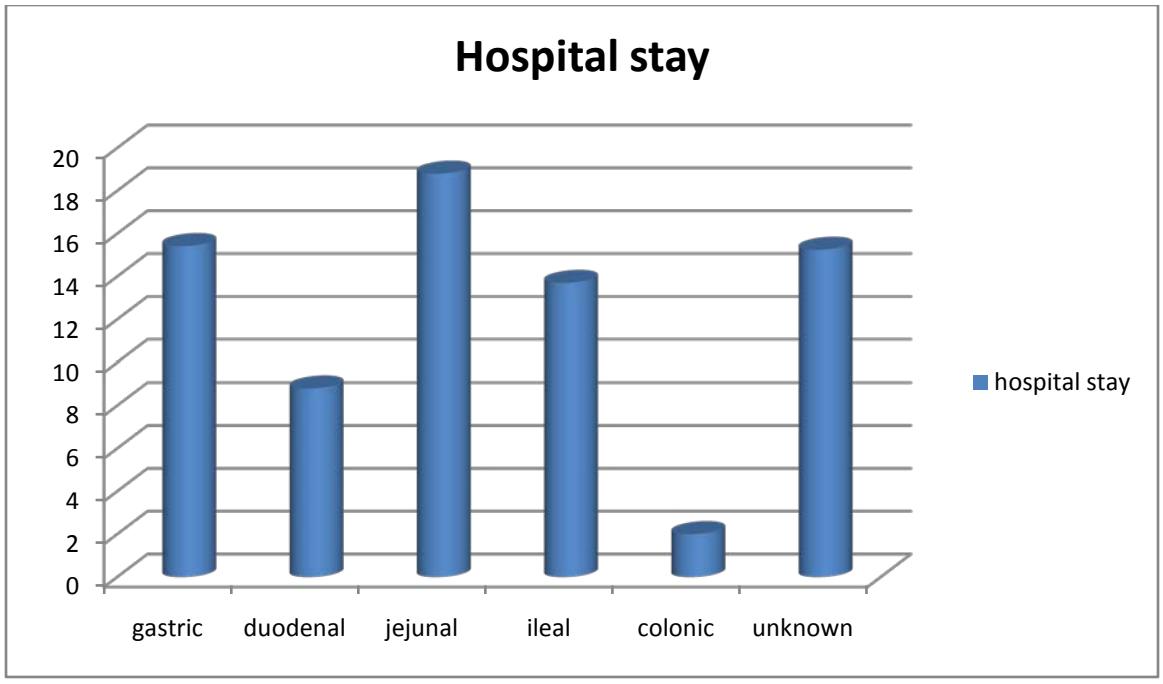
We could classify the patients according to the site of perforation. The bulk of the perforations were due to duodenal perforation contributing 57% of cases followed by Jejunal (19%), Gastric (9%), Ileal (9%), and Colonic perforation (2%). The Cause was not made out for 4 patients in whom flank drain was put and they did not require further surgery as they recovered with conservative management.

	Gastric	Duodenal	Jejunal	Ileal	Colonic	Unknown
Number	9	57	19	9	2	4
Death	2	6	4	1	2	0
Hospital stay	15.42days	8.8 days	18.8 days	13.7days	2 days	15.25days

The patients having duodenal perforations have a lesser hospital stay and early recovery. Whereas highest hospital stay was found in the patients with jejunal perforation followed by gastric and patients put on flank drain. Colonic perforation has a lower hospital stay as the two patients died in immediate post operative period.

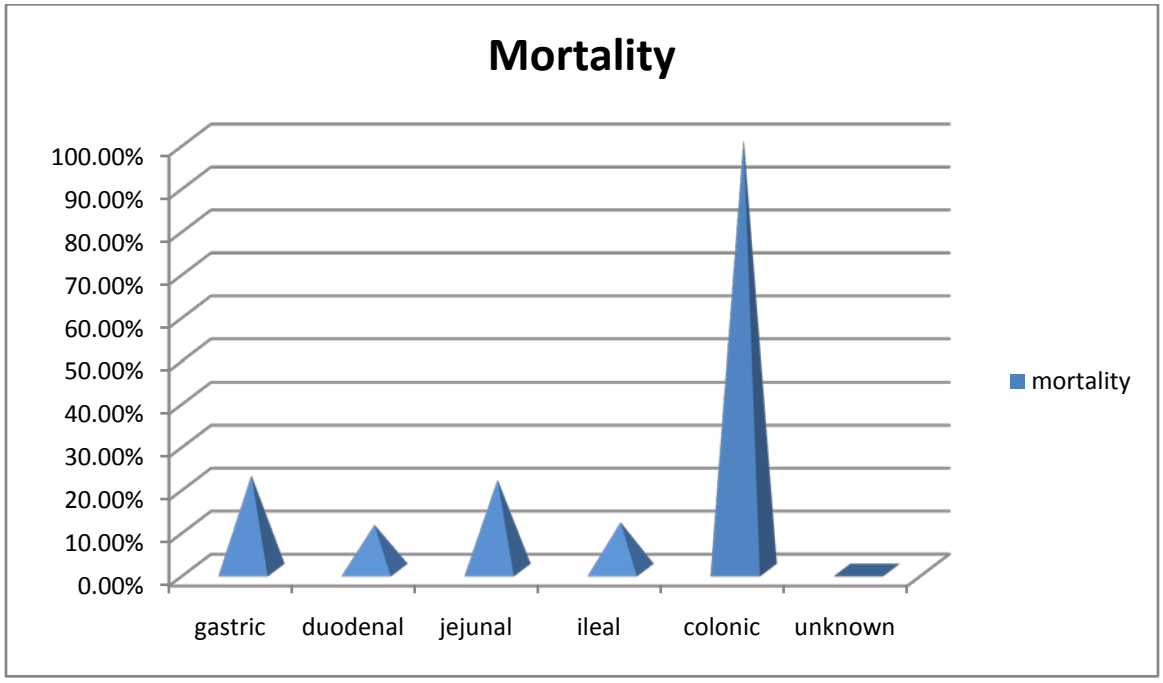


Most common etiology was found to be duodenal perforation followed by jejunal perforation.



Hospital stay was found to be highest in cases of jejunal perforation.

Mortality According to Site of Perforation



The number of death in each type of perforation is shown in table 3 and the mortality rate in each category is shown in the above chart. The highest mortality rate was found in the group of colonic perforation followed by jejunal perforation.

Though the duodenal perforations formed the bulk of the diagnosis mortality was relatively low.

Morbidity Analysis

The various complications were recorded. The most common complications were found to be wound infection and respiratory complications followed by the urinary tract infections and enterocutaneous fistulas. Intra abdominal abscesses were found to be lower in number.

	WI	WD	RC	UTI	IAA	ECF
Number	19	4	19	12	2	5

WI- wound infection WD- wound dehiscence

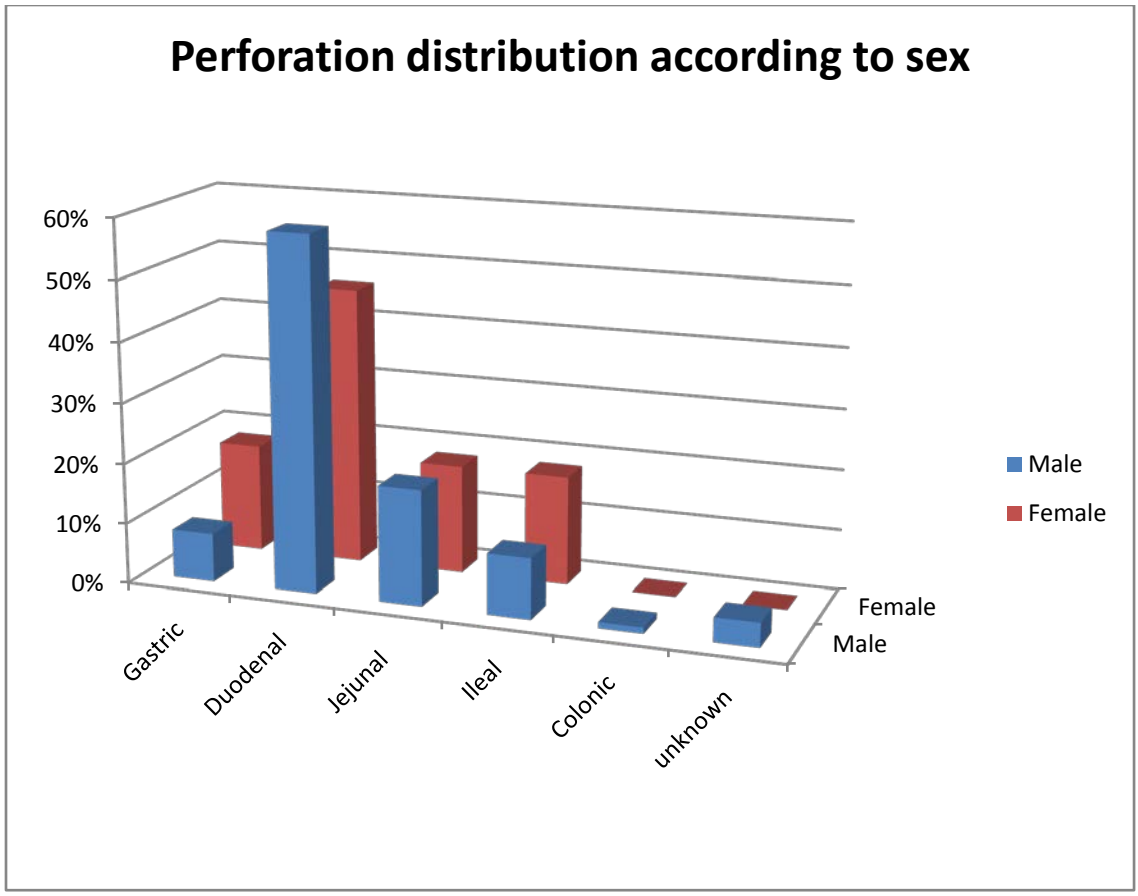
RC- respiratory complications UTI- urinary tract infections

IAA- intra abdominal abscess ECF- enterocutaneous fistula

Males vs. Females

Location of ulcer

	Gastric	Duodenal	Jejunal	Ileal	Colonic	Unknown
Males	7	52	17	9	2	4
Females	2	5	2	2	-	-



The chart shows percentage wise distribution of perforations in males and females. It can be seen that though duodenal perforation is the most common cause in both males and females, there were higher number of gastric and ileal perforations in females as compared to males.

Complications in Males and Females

	WI	WD	RC	IAA	UTI	ECF
Males	18	4	17	4	10	5
Females	0	0	0	0	2	0

WI- wound infection WD- wound dehiscence

RC- respiratory complications UTI- urinary tract infections

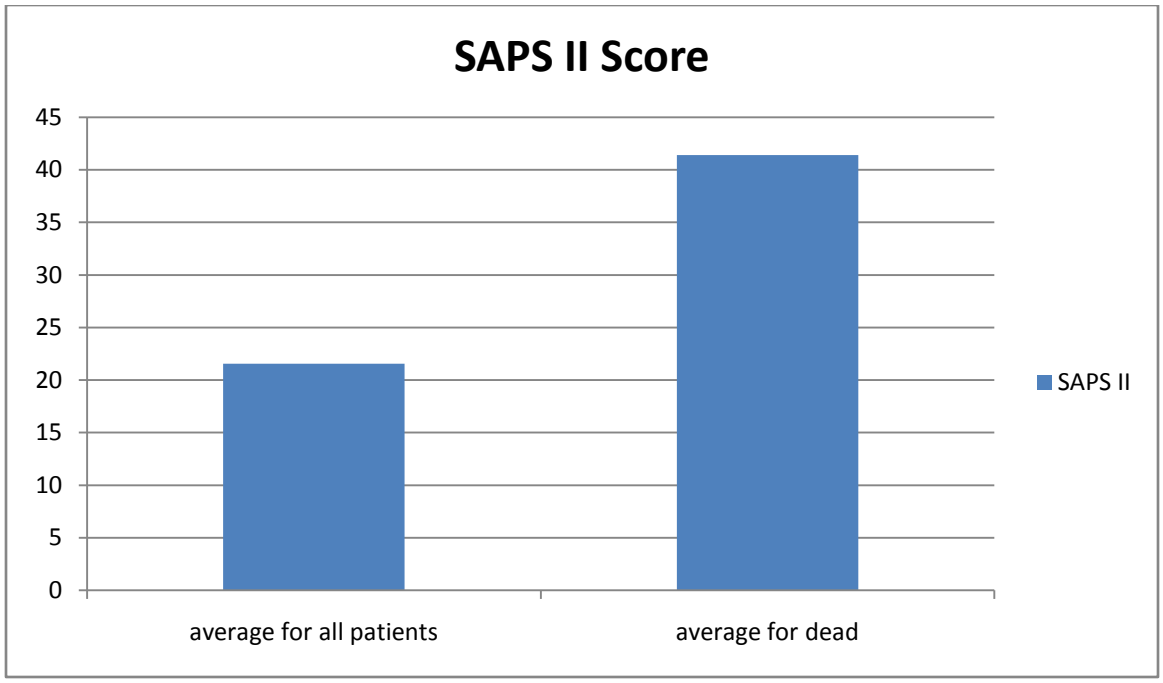
IAA- intra abdominal abscess ECF- enterocutaneous fistula

The complications were found to be higher in males. Almost all the complications were confined to male population while only 2 females suffered from complication which was urinary tract infection.

SAPS II in study population

The SAPS II scoring was applied to all these cases. The average SAPS II score for all the cases is 21.56

The average SAPSII scoring for the 15 patients who died was found to be 41.4



Complications in individual anatomic sites

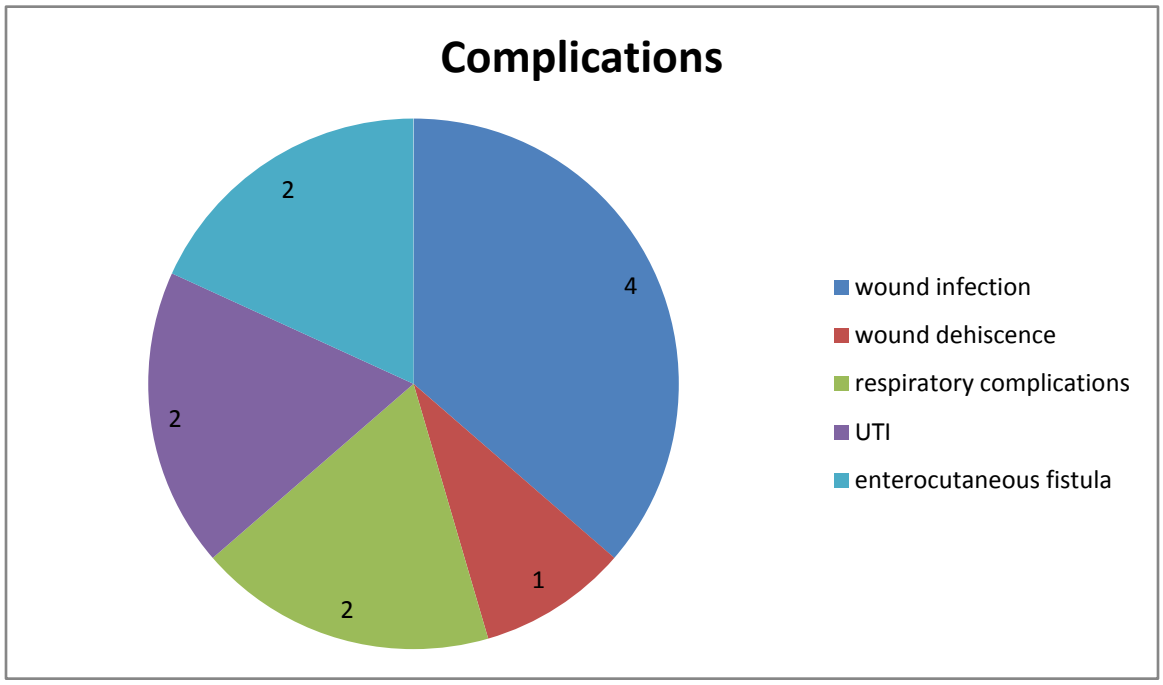
The complications were found to be highest in the jejunal perforations. Followed by gastric perforation

Wound infection was found to be highest in jejunal perforations whereas respiratory complications were highest in the duodenal perforations. 2 cases that had intra abdominal abscess were both having jejunal perforations. Enterocutaneous fistula was found to be higher in gastric perforation.

The various complications according to the individual site of perforation are shown in the following table.

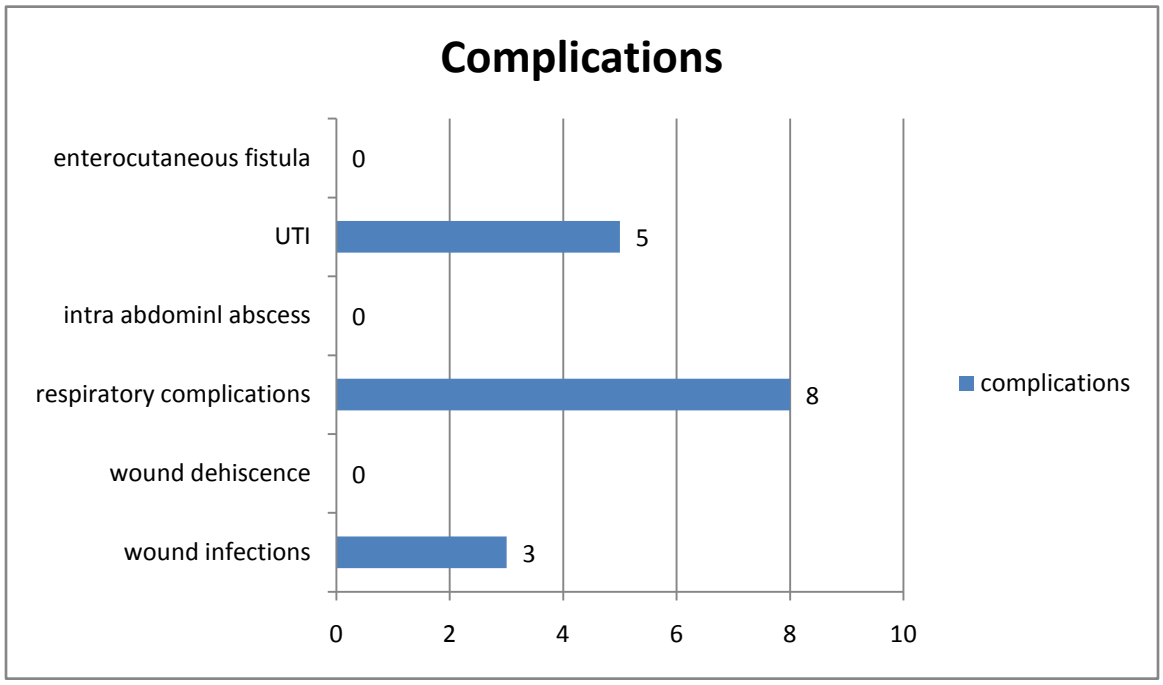
	WI	WD	RC	IAA	UTI	ECF
Gastric	4	1	2	0	2	2
Duodenal	3	0	8	0	5	0
Jejunal	7	2	2	2	4	2
Ileal	2	1	3	0	1	1
Flank drain	2	0	2	2	0	0

Gastric perforation



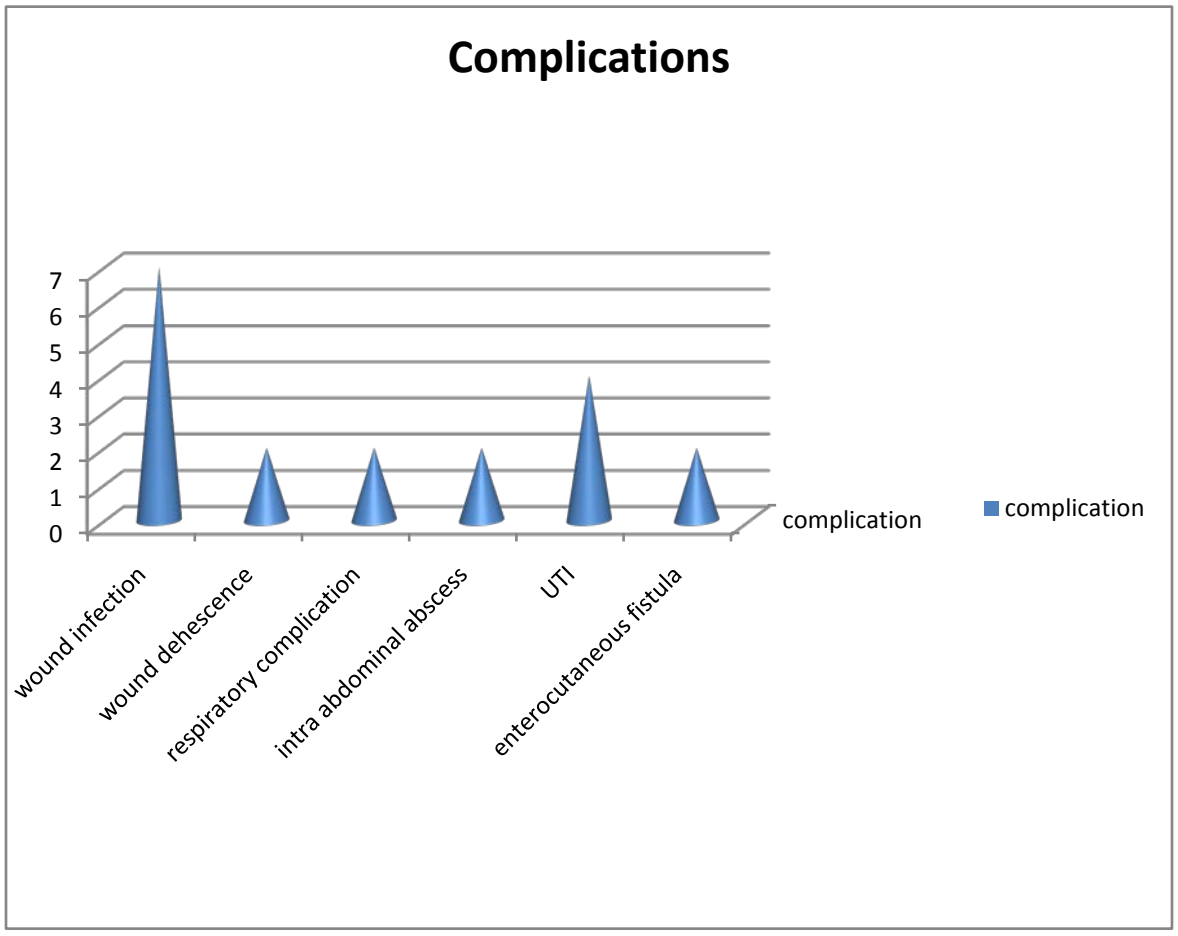
Most common complication in gastric perforation was wound infection followed by UTI and enterocutaneous fistula. 44% of patients with gastric perforation suffered from wound infection. Respiratory complications, UTI, and enterocutaneous fistula were found in 22% each. 66% of patients with gastric perforation suffered from some kind of complication.

Duodenal perforation



Respiratory complications were the most common complication found in duodenal perforation there were no cases of wound dehiscence, intra abdominal abscess or enterocutaneous fistulas. 14% of the patients had respiratory complications and 8% of them had UTI. Totally only 28% of the patients had any complication at all in duodenal perforation.

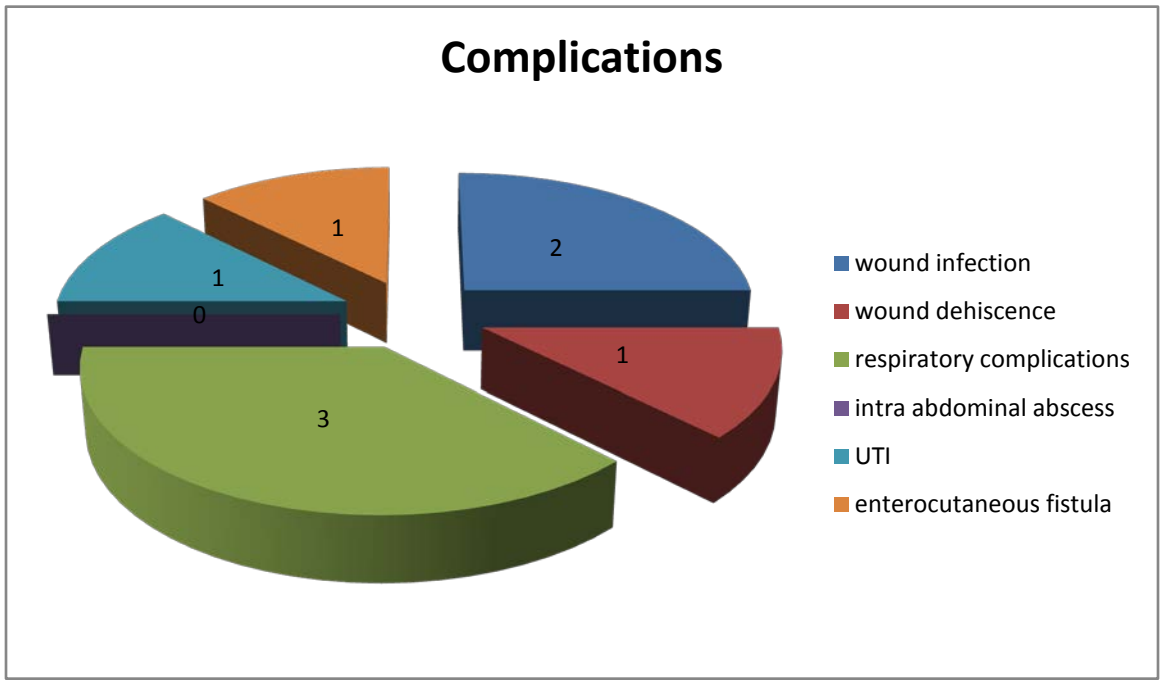
Jejunal perforation



Wound infection is the most common complication in jejunal perforations. Intra abdominal abscesses were found only in jejunal perforation. Two patients developed wound dehiscence and two patients developed enterocutaneous fistula.

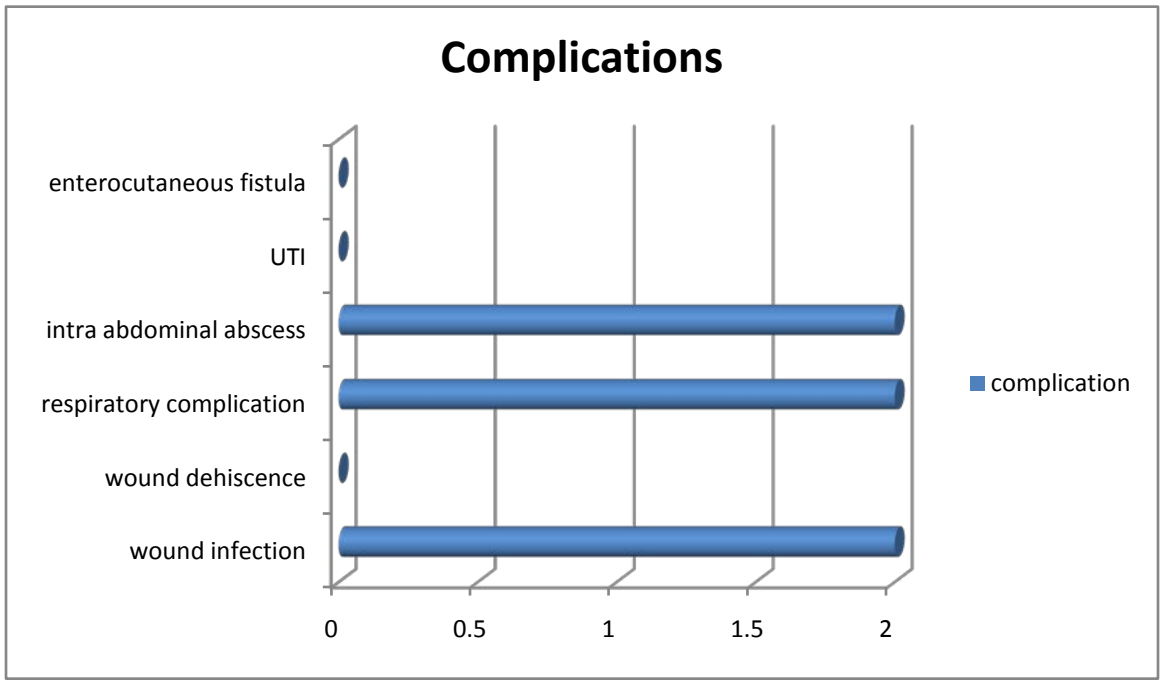
Wound infection was found in 32% of the population having jejunal perforation. Totally 42% of patients having jejunal perforation suffered from some kind of complication.

Ileal perforation



Respiratory complications were the most common complication in ileal perforation followed by wound infection. 33% of patients suffering from ileal perforation had suffered from respiratory complications, whereas 22% suffered from wound infection. Totally 44% of patients having ileal perforation suffered from some type of complication.

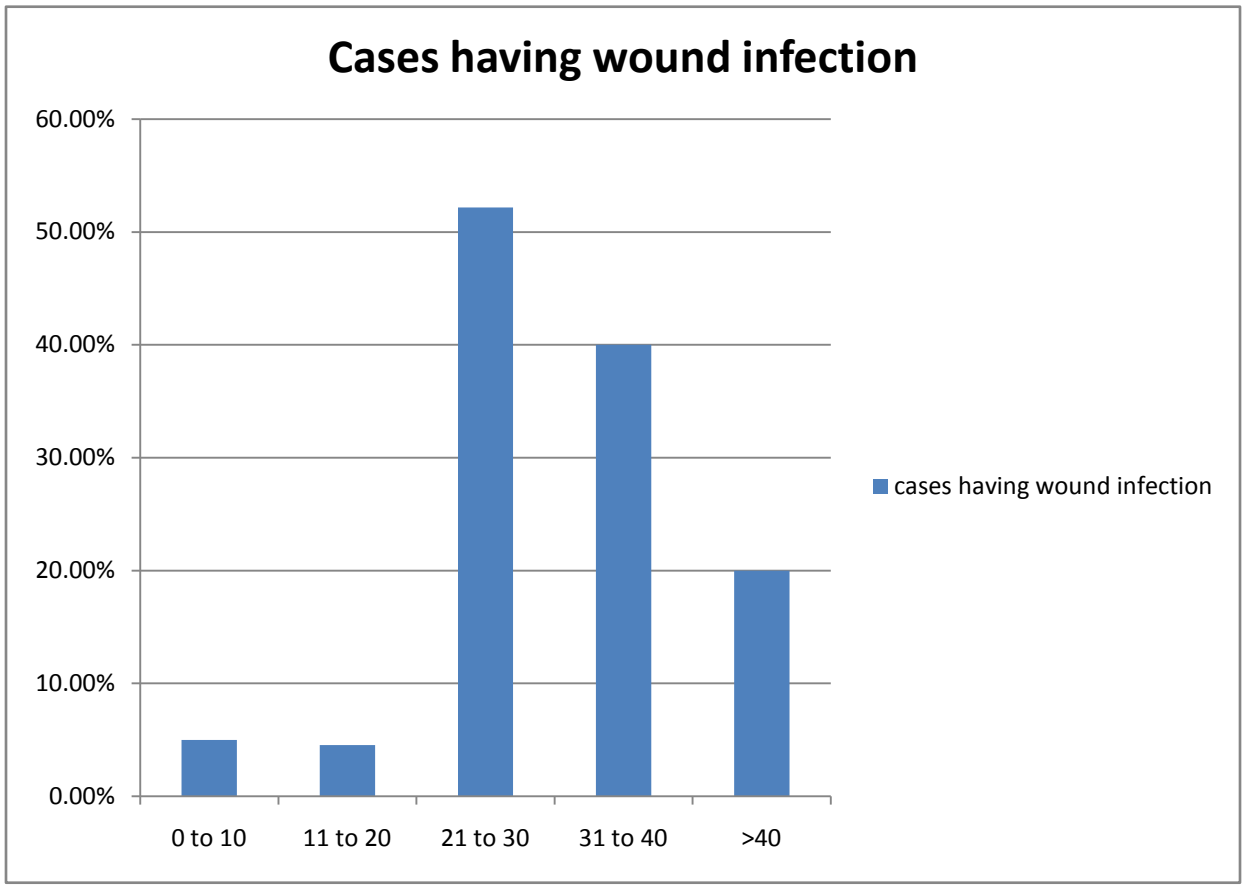
Unknown perforation/ Flank Drain



Complications were high in patients who underwent just flank drain. Two patients that is 50% developed intra abdominal abscess, respiratory complications and wound infection at the drain site. But the survival in the cases of patients undergoing flank drain was found to be 100%. This may be attributed to immediate drainage of the peritoneal sepsis and also these patients may have gained from lack of stress due to anesthesia and surgery. Further studies may be required to prove the efficacy of flank drainage without definitive surgery.

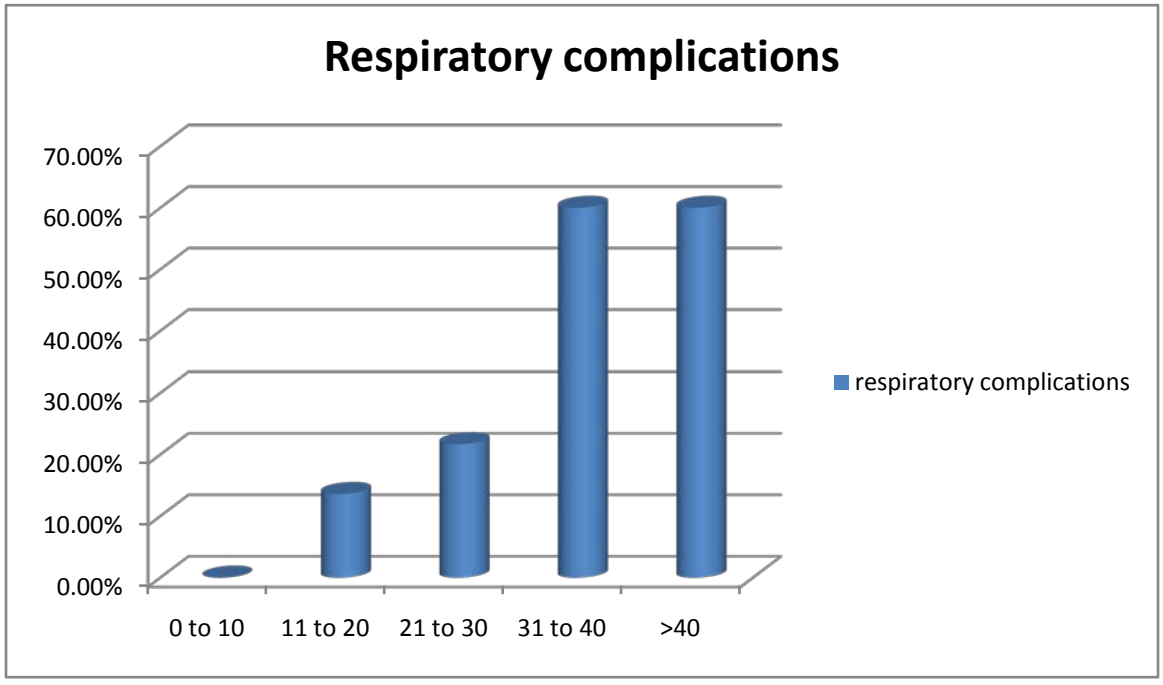
Analysis of complications with SAPS II scoring

Wound infection



When we evaluate the incidence of wound infections according to SAPS II score we find that when SAPS score is less than 20 the wound infection rate is very low where as with higher SAPS scoring there is an increased wound infection rate. The wound infection rate in cases with SAPS above 40 is lower than those with 20 to 40 as many cases died in early post operative period before developing wound infection.

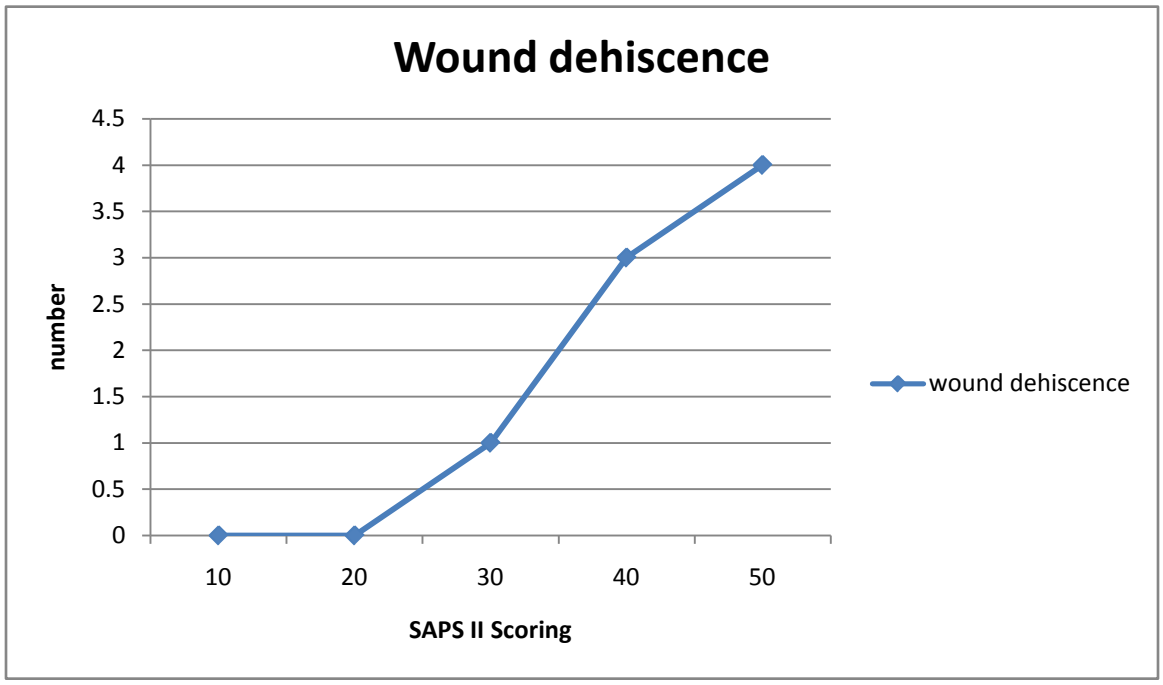
Respiratory complications



Respiratory complications had a linear relation with SAPS II scoring. Respiratory complications were actually the cause for most of the deaths.

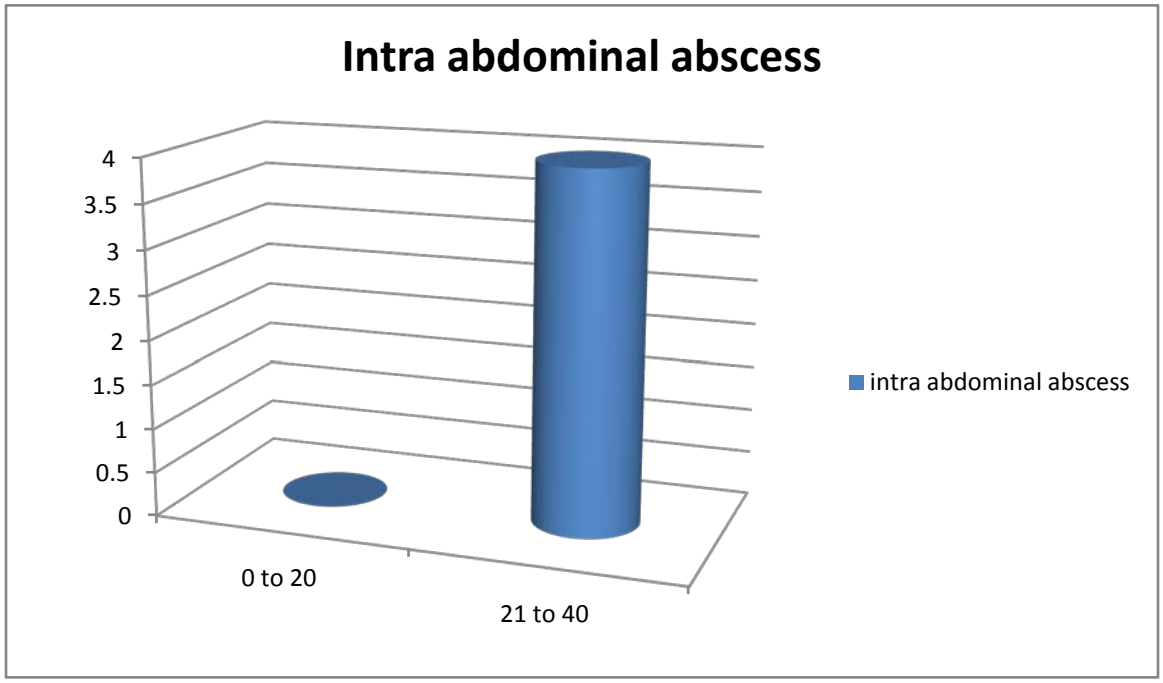
Thus we see 60 % of patients with SAPS II scoring between 31 and 40 and those having above 40 developing respiratory complications.

Wound dehiscence



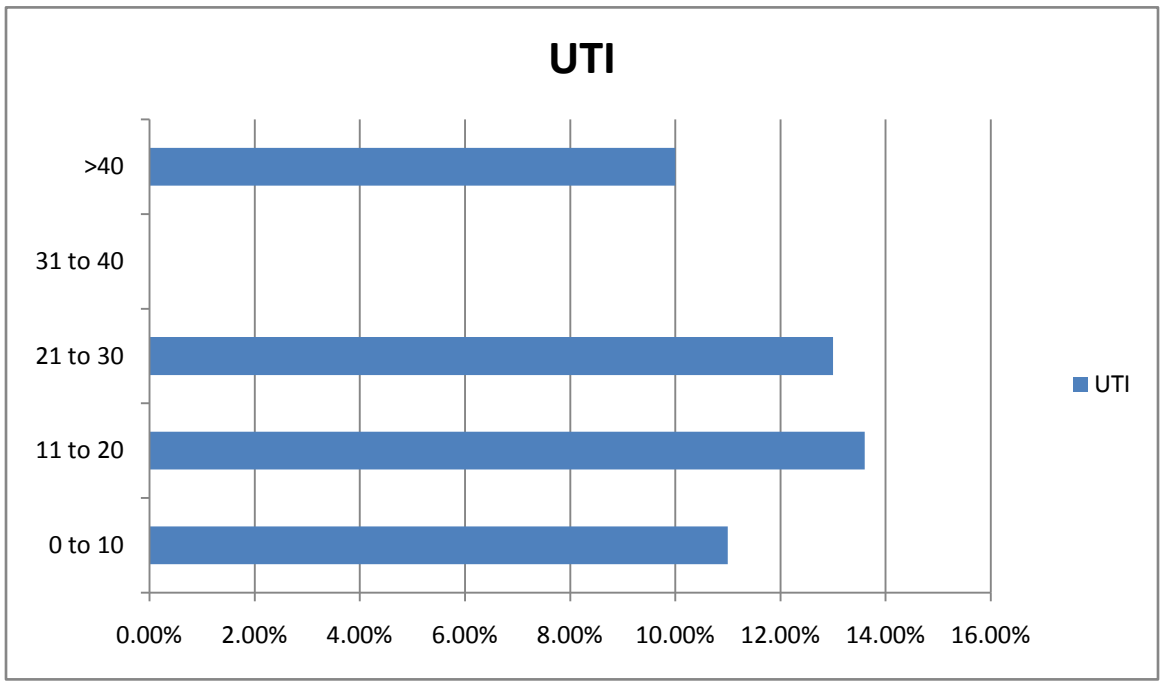
This is a cumulative chart which shows increasing number of patients having wound dehiscence as the SAPS scoring increases. A SAPS score below 20 has no wound dehiscence whereas when it is 30 to 40, 40% cases have wound dehiscence.

Intra abdominal abscess



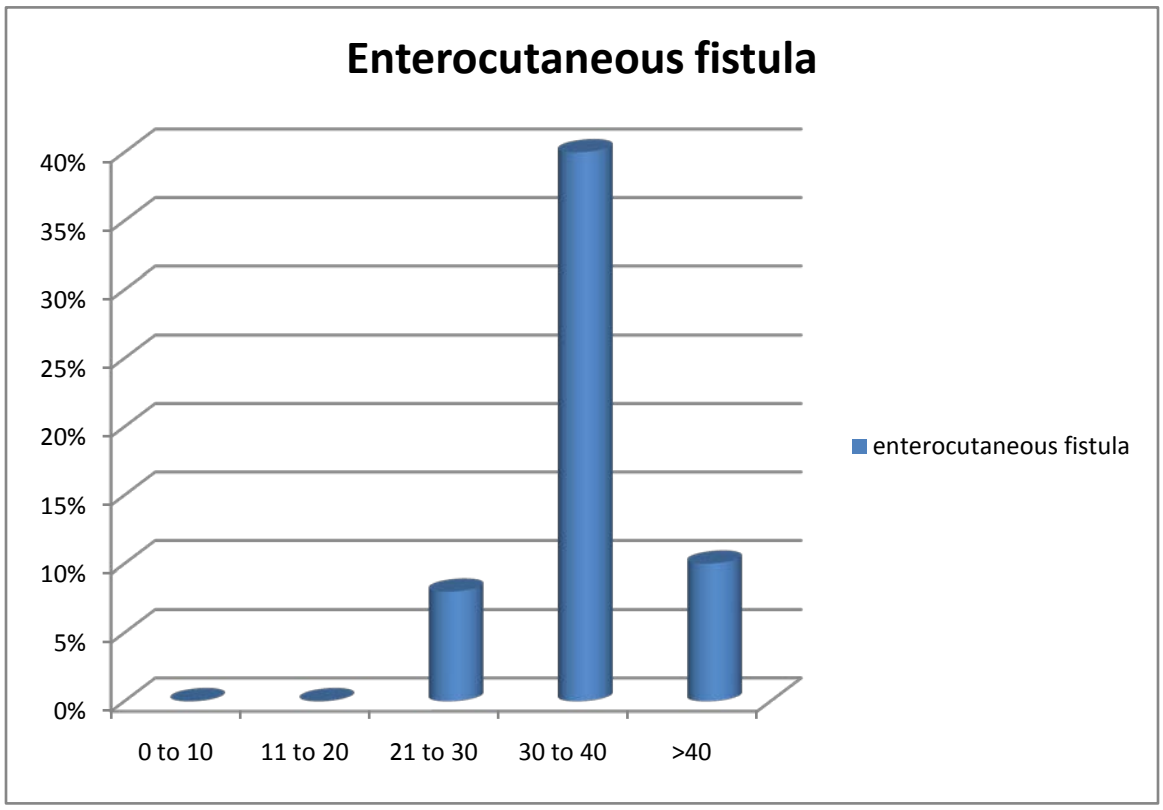
Of the 4 cases having intra abdominal abscess all of them came under the group having SAPS II score as 20 to 40. It was totally absent in cases having a score below 20.

Urinary tract infections



Urinary Tract Infections were almost uniformly distributed throughout the range of SAPS scoring. This was probably due to almost universal use of bladder catheters in patients and indwelling catheter being a single most prominent risk factor for developing UTI.

Enterocutaneous Fistula



Enterocutaneous fistulas had the similar distribution to the other complications, being highest in the 30 to 40 range and being absent below a SAPS II score of 20.

Relaparotomy

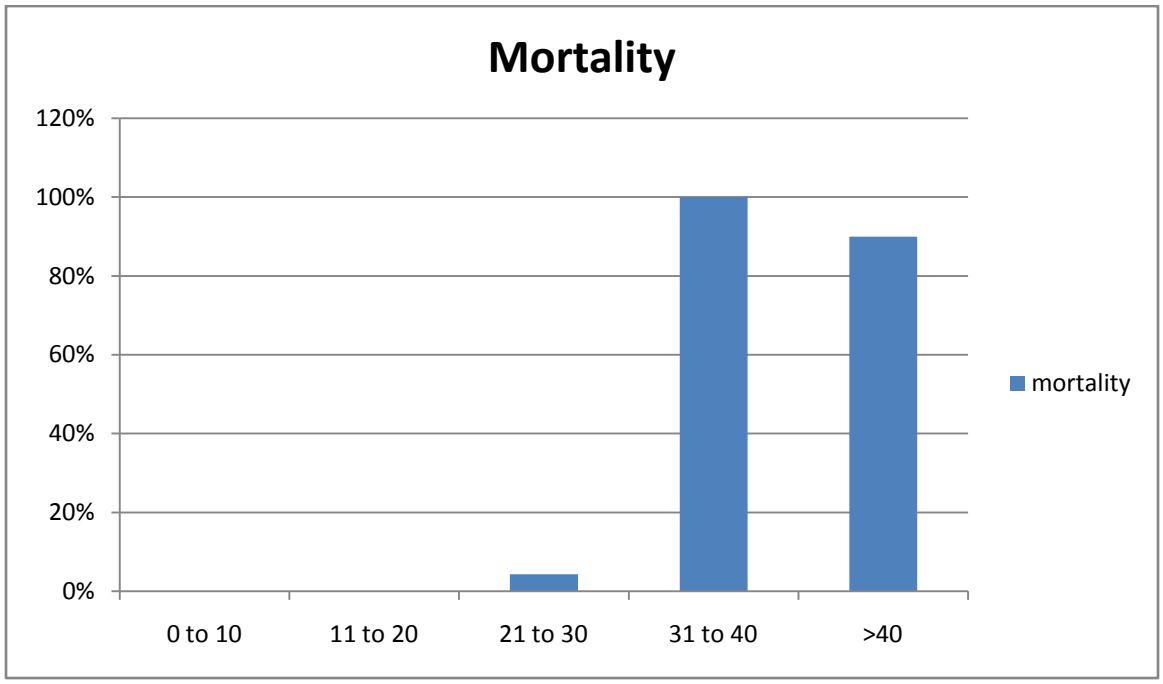
There were 5 patients who underwent relaparotomy. The cause of re laparotomy was being the presence of enterocutaneous fistula. The patients who underwent relaparotomy had an average SAPSII score of 36.

Comparison of SAPS II scoring in Male and Female group and its association to Hospital Stay

	SAPS II	Hospital Stay
Male	21.89	11.11 days
Female	18.18	9.22 days

The average SAPS II scoring in males was found to be slightly higher in males which correlates well with the increased hospital stay as well as higher morbidity in male population.

Comparison of mortality with SAPS II score



There was no mortality when the SAPS II score was less than 20. There was one death in 21 to 30 group who had a SAPS II scoring of 28. There was 100% mortality in group of 31 to 40. Of this group all of the cases had a SAPS II score of 38. Above 40 there was 90% mortality. The one survivor having SAPS II score above 40 had significant morbidity in form of severe wound infection leading to wound dehiscence and also an enterocutaneous fistula requiring relaparotomy.

Comparison of Predicted mortality to actual mortality

SAPS II score	Predicted mortality	Actual mortality
0-20	2.16%	0
21-40	10.3%	21.42%
>40	34.75%	90%

The average predicted mortality given by SAPS II scoring is given and compared with the actual mortality in each group. The SAPS II scoring under predicts the mortality in the group of high risk patients. The predicted mortality correlates with that of the moderate risk patients while it slightly over predicts mortality in the low risk group.

Discussion

Perforation peritonitis is one of the most common emergency surgical cases admitted to our hospital.

Our study included 100 patients of which there was a male predominance of 8:1.

Most patients belonged to the age group of 20 to 40. This is in contrast to western statistics in which mean age is 45 to 60.

The most common etiology was duodenal ulcer perforation, followed by jejunal perforations and ileal and gastric perforations. This is in concurrence to Rajender et al who in their study had duodenal perforation as the most common cause. But in their study gastric and ileal perforations were higher than jejunal perforations [(26)].

There was a difference in the etiology of perforation in our male and female population. Gastric perforation were found at a higher frequency in females so were the ilial perforations when compared to male population.

The complication rate was also less in the female population when compared to male population which reflects in their lower hospital stay and lesser average SAPS II score.

The perforation of proximal gastro intestinal tract is most common as compared to western statistics which site at lower gastrointestinal tract.

This may be due to the higher incidence of H.pylori infection in our population and a lack of knowledge in peripheral doctors as well as the general population about the effective treatment of gastritis and gastroduodenal ulcers.

Major cause of post operative morbidity were

- wound infection and
- respiratory complications.

This is corresponding with the results of various other studies on perforation peritonitis.

The duration of hospital stay which is the reflection of all the complication as well as morbidity in a patient due to the particular disease also rises linearly with increase in SAPS II score.

- Mean hospital stay is 10.9 days.
- It reduces to 9 days when SAPS II score is less than 20 and
- Rises to about 16 days when the score is 20 to 40.

The complications have been most common in the group of patients having a SAPS II score of 20- 40.

Those who have a score above 40 have higher mortality hence they did not live long enough for complication to develop.

The result of this study is similar when compared to different studies on SAPS II scoring conducted for peritonitis as well as for other diseases.

With scores below 20, 21 to 30, 31 to 40 and above 40 the mortality is respectively 0, 4, 100 and 90% which correlates with Prakash et al who in their study published in JIACM 2006; 7(3): 202-5 got a result of a mortality rate of 0, 16, 62,75% with SAPS score <10, 11-30, 31-60 and >60.

Gauzit, Rémy *et al* in their study published in Surgical Infections , Volume 10 (2) Mary Ann Liebert – Apr 1, 2009 published that a SAPS II scoring >38 is associated with high mortality which correlates with our study [(25)].

Mehmet F. Can , Gohkan Yagci et al in their article in Socie ´te ´ Internationale de Chirurgie 2008 indicate a SAPS II scoring above 25 to be a greater risk for morbidity and mortality which correlates with our study where most of the complications have occurred in patients with a SAPS II score above 20 and all the deaths have occurred in patients having a SAPS II score above 25.

Here we can classify our patients into three subgroups based on their SAPS II score.

- First group with a very low mortbidity and mortality with a score below 20,
- second group with a moderately high morbidity and mortality with SAPS II score between 21 to 40 and
- the third group with highest mortality with SAPS II score above 40

	Low risk	Moderate risk	High risk
SAPS II score	0 to 20	21 to 40	Above 40
Hospital stay	9.11 days	15.54 days	21 days*
Death	Nil	6 (21.4%)	9 (90%)

*the hospital stay was of the one survivor in the group.

In our study,

- 62 cases were in low risk group with nil mortality,
- 28 cases in moderate risk group with 21.4% mortality and
- 10 patients in high risk group with 90% mortality.

Based on this classification we can triage the patients in the government hospitals where the patients are in plenty but the resources are limited.

Most of the mortality was due to multi organ failure due to septicemia occurring in immediate post operative period with a mean hospital stay of 5.4 days.

The operative risk is high in these patients and the results are poor.

The patients with a SAPS score less than 20 usually did well post operatively with minimal complications.

But the bulk of morbidity was found in the group having a SAPS II score of 21 to 40. More care may be needed for these patients who with proper care will do well but with a little of neglect can sink towards their deaths.

Conclusion

- Among the patients studied, duodenal ulcer perforation was the commonest cause for perforation peritonitis.
- Predominance of male over female in acute generalized peritonitis with the ratio of 8:1
- People in the age group of 3^{rd} and 4^{th} decade were commonly involved in perforation peritonitis.
- Most common complications in perforation peritonitis were seen to be wound infection and respiratory complication
- Overall mortality in patients with perforation peritonitis was 15%.
- SAPS II scores predicted the mortality fairly accurately in the patients with acute perforation peritonitis.
- SAPS II scores correlate with the development of complications in patients of perforation peritonitis. As the SAPS II score has increased so has the complications
- The most dreaded complication was found to be enterocutaneous fistula which required re laparotomy. It had a high mortality of more than 50 percent.

- Though the predicted mortality given by SAPS score may be underestimating the actual mortality the mortality is definitely higher in the patients having higher SAPS score

We conclude that SAPS II is a very good tool for predicting mortality and morbidity in patients with perforation peritonitis and it helps to classify and triage the patients to different groups, in whom different approach towards management can be planned.

REFERENCES

1. Mcminn's Lasts Anatomy Regional & Applied 9e p 312-313
2. B. D.Chaurasia, Human Anatomy 3e Vol 2, p 190-192
3. Current Surgical Diagnosis And Treatment 12e, p 819-825
4. Hamilton Bailey's Emergency Surgery 13e, p 315-319, p 350-353
5. Joseph E. Fischer's Mastery of Surgery 5e,p 2149-2167
6. Dellinger EP.Use of scoring systems to assess patients with surgical sepsis.Surgical clinics of North America 1988; 68(1): 123-145.
7. Knaus WA, Zimmerman JE, Wagner DP, Draper EA, Lawrence DE.; APACHE – acute physiology and chronic health evaluation: a physiologically based classification.Critical Care Medicine 1981; 9: 591-597.
8. Seneff m, Knaus WA Predicting patient outcome from intensive care: a guideto APACHE, MPM, SAPS, PRISM, and other prognostic scoring systems. Journal of Intensive care medicine 1990; 5:33-52.
9. Knaus WA, Draper EA, Wagner DP, Zimmerman JE.; APACHE II: A severity of disease classification system. Critical Care Medicine 1985; 13: 818-829.

10. Cerra FB, Negro F, Abrams J.; APACHE II scores does not predict multiple organ failure or mortality in postoperative general surgical patients. Archives of Surgery 1990; 125: 519-522.
11. Bohnen JMA, Mustard RA, Oxholm SE, Schouten D.; APACHE II score and abdominal sepsis. Archives of Surgery 1988; 123: 225-229.18.
12. Koperna T, Schulz F. Prognosis and treatment of peritonitis. Do we need new scoring systems? Archives of Surgery 1996; 131: 180-185.
13. Marsh HM, Krishnan I, Naessens JM, Strickland RA, Gracey DR, Campion ME, Nobrega FT, Southorn PA, McMichan JC, Kelly MP. Assessment of prediction of mortality by using the APACHE II scoring system in intensive care units. Mayo Clinical Procedures 1990; 65: 1549-1557.
14. Zimmerman JE, Knaus WA. Outcome prediction in adult intensive care. In: Schomaker MC, Thompson WL, Holbrook PH, et al (ed). Textbook of critical care, 2nd edition. Philadelphia: Saunders, 1988: 1447-1465. Cited by Seneff M (2).
15. Borlase BC, Baxter JT, Benotti PN, Stone M, Wood E, Forse RA, Blackburn GL, Steele Jr. G. Surgical intensive care unit resource use in a specialty referral hospital. Predictors of early death and cost implications. Surgery 1991; 109: k687-693.

16. Chang RWS, Jacobs S, Lee B, Pace N. Predicting deaths among intensive care unit patients. Critical Care Medicine 1988; 16: 34-42.
17. Billing A, Frohlich D, Schildberg FW. Prediction of outcome using the Manheim peritonitis index in 2003 patients. British Journal of Surgery 1994; 81: 209-213.
18. Fleiss JL. Statistical Methods for Rates and Proportions. 2 e. New York,NY: John Wiley and Sons Inc; 1981
19. Lemshow S, Teres D, Pastides H, Avruninin JS. A method for predictin survival and mortality of ICU patients using objectively derived weights. Crit Care Med. 1985; 13:519-525
20. Lemshow S, Teres D, Pastides H, Avruninin JS. A method for predictin survival and mortality of ICU patients using objectively derived weights. Crit Care Med. 1988; 16: 470-477
21. Lemshow S, Teres D, Klar J, Avrunin JS, Gehlbach SH, RapportJ. Mortality Probability Models (MPM II) based on an international cohort of intensive care patients. JAMA. 1993;270:2478-2486
22. Cleveland WS. Robust; Locally weighted regression and smoothing scatterplots. J AM Stat Assoc. 1979; 74: 829-836
23. Hosmer DW, Lemshow S. Applied Logistic Regression. New York, NY: John wiley and sons inc; 1989

24. Hanley JA, Mcneil BJ. The meaning and use of the area under a receiver operating characteristics (ROC) curve. Radiology. 1982; 143:29-36.

25. Gauzit R, Péan Y, Barth X, Mistretta F, Lalaude O; Epidemiology, management, and prognosis of secondary non-postoperative peritonitis: a French prospective observational multicenter study.; Top Study Team.Département d'Anesthésie Réanimation, Assistance Publique Hôpitaux de Paris, CHU Hôtel-Dieu, Paris, France.

26. Rajender S Jhobta, Ashok K Attri, Robin Kaushik, Rajeev Sharma and Anupam Jhobta; Spectrum of perforation peritonitis in India-review of 504 consecutive cases; *World Journal of Emergency Surgery 2006, **1**:26*

PROFORMA

Patient particulars

- Name
- Age
- Sex
- IP No
- Address
- DOA
- DOS
- DOD

History

- Complaints
- History of present illness
- History of Chronic Diseases

General Physical Examination

- Pulse
- Blood Pressure
- Temperature
- Hydration
- GCS

Examination of Abdomen

- Inspection
- Palpation
- Percussion
- Auscultation
- PR examination

Systemic Examination

- Respiratory System
- Cardiovascular System
- Central Nervous System

Investigations

- WBC Count
- Serum Sodium
- Serum Potassium
- Serum Bicarbonate
- Blood Urea
- Serum Bilirubin
- Chest X-Ray
- Erect X-Ray Abdomen
- USG Abdomen

Operative Notes

- Presence of Perforation
- Site
- Size
- Anesthesia

Requirement of Ventilatory Support

- FiO_2

Post Operative Period

- Wound Infection
- Wound Dehiscence
- Respiratory Complications
- Urinary Tract Infection
- Intra Abdominal Abscess

Relaparotomy

Name:
Age:
IP No:
DOA:
DOS:
DOD:

New Simplified Acute Physiology Score (SAPS) II

(worst value in the first 24 hours)

Variable	26	13	12	11	9	7	6	5	4	3	2	0	1	2	3	4	6	7	8	9	10	12	15	16	17	18
Age												<40						40-59				60-69	70-74	75-79		≥80
Heart rate				<40							40-69	70-119				120-159		≥160								
Systolic blood pressure		<70						70-99				100-199		≥200												
Temperature												<39°C <102.2°F			≥39°C ≥102.2°F											
If ventilated or CPAP PaO_2/FiO_2 mmHg (kPa)				<100 (<13.3)	100-199 (13.3-26.5)		>200 (>26.6)																			
Urine output/day									500-999			≥1000														
S. urea, mmol/l (g/l)												<10.0 (<0.60)					10.0-29.9 (6.0-1.79)				≥30.0 (≥1.80)					
WBC (10^3/cu mm)			<1.0									1.0-19.9			≥20.0											
S. Potassium										<3.0		3.0-4.9			≥5.0											
S. Sodium								<125				125-144	≥145													
S.Bicarb							<15			15-19		≥20														
Bilirubin micromol/l (mg/l)												<68.4 (<4.0)				68.4-102.5 (4.0-5.9)										
GCS	<6	6-8				9-10		11-13				14-15														
Chronic diseases																				Metastatic cancer	Haematologic malignancy				AIDS	
Type of admission												Scheduled surgical							Unscheduled surgical							
Sum of points																										

Total SAPS score (0 to 163) = _____ points logit= -7.7631 + 0.0737 (SAPS II score) + 0.9971 (ln (SAPS II score+1))

Risk of hospital death = $e^{logit}/1 + e^{logit}$

Appendix-3

MASTER CHART

Serial no	Name	Age	IP NO.	DOA	DOD	HEART RATE	BP	GCS	URINE OUTPUT	temperature	WBC	S. Na	S. K	S. HC03	S. BILI	S. UREA	CPAP/Fio2	admission	chronic diseases	anatomical site	SAPSII	predicted mortality	stay	wound infection	wound dehiscence	resp comp	intra abd abs	UTI	re lap	ent cu fist
1	vijayakumar	24/M	37865	30/6/2012	8/7/2012	100	110	15	1.4	97.3	4500	137	3.8	29	1	36	NA	emer	nil	DUP	8	0.70%	8	neg	neg	neg	neg	neg	neg	neg
2	jagadish	22/M	38678	5/7/2012	24/7/2012	108	120	15	2	98.6	5700	138	3.6	29	1	36	NA	emer	nil	DUP	8	0.70%	9	neg	neg	neg	neg	neg	neg	neg
3	rajkumar	30/M	40357	13/7/2012	20/7/2012	97	120	15	1.4	97.4	4300	132	3.6	27	1	28	NA	emer	nil	DUP	8	0.70%	7	neg	neg	neg	neg	neg	neg	neg
4	manikandan	36/M	42728	24/7/2012	1/8/2012	93	112	15	1.4	98.3	4500	139	3.6	27	1	27	NA	emer	nil	DUP	8	0.70%	7	neg	neg	neg	neg	neg	neg	neg
5	govinda	25/M	44464	2/8/2012	11/8/2012	102	120	15	1.9	98.3	4300	134	4.6	28	1	32	NA	emer	nil	DUP	8	0.70%	9	neg	neg	neg	neg	neg	neg	neg
6	sathya	32/F	45972	9/8/2012	16/8/2012	106	120	15	1.5	101	7300	139	3.9	27	1	28	NA	emer	nil	jej	8	0.70%	7	neg	neg	neg	neg	neg	neg	neg
7	satishkumar	28/M	45866	20/8/2012	30/8/2012	104	116	15	1.4	99.1	4300	139	3.2	28	1	26	NA	emer	nil	JEJ	8	0.70%	10	pos	neg	neg	neg	neg	neg	neg
8	rajendra	17/M	48750	23/8/2012	30/2012	90	110	15	2.2	100	5300	137	3.8	29	2	32	NA	emer	nil	DUP	8	0.70%	7	neg	neg	neg	neg	neg	neg	neg
9	karthik	24/M`	60348	22/10/2012	31/10/2012	105	120	15	1.7	94	5200	136	3.5	30	2	25	NA	emer	nil	DUP	8	0.70%	9	neg	neg	neg	neg	pos	neg	neg
10	krishnamoorthy	27/M	64418	13/11/2011	21/11/2011	110	100	15	1.3	98	5700	138	3.9	26	1	38	NA	emer	nil	DUP	8	0.70%	8	neg	neg	neg	neg	neg	neg	neg
11	muniraj	38/M	60850	25/10/2012	2/11/2011	102	120	15	2	102	5300	140	3.9	29	3	35	NA	emer	nil	DUP	8	0.70%	7	neg	neg	neg	neg	neg	neg	neg
12	senthil	29/M	72234	20/12/2012	28/12/2012	116	104	14	1.4	100	4500	135	3.4	20	1	35	NA	emer	nil	DUP	8	0.70%	6	neg	neg	neg	neg	neg	neg	neg
13	kumar	34/M	2071	9/1/2012	19/1/2012	110	120	15	1.5	98	11000	134	3.4	26	1	34	NA	emer	nil	DUP	8	0.70%	10	neg	neg	neg	neg	neg	neg	neg
14	nakul	20/M	67748	7/11/2012	15/11/2012	96	120	15	1.9	98.6	5000	133	4	29	1	24	NA	emer	nil	DUP	8	0.70%	8	neg	neg	neg	neg	neg	neg	neg
15	musuli	22/M	50147	5/9/2011	14/9/11	100	108	15	2.2	98.5	6000	141	3.2	24	1	37	NA	emer	nil	DUP	8	0.70%	9	neg	neg	neg	neg	neg	neg	neg
16	papammal	38/F	60814	25/10/2011	2/11/2011	109	110	15	1.6	99.8	5400	135	3.5	23	1	34	NA	emer	nil	ILEAL	8	0.70%	8	neg	neg	neg	neg	neg	neg	neg
17	rajeshwari	22/F	1367	8/1/2012	20/1/2012	98	100	15	1.8	98.2	6500	136	3.9	20	2	48	NA	emer	nil	GAS	8	0.70%	12	neg	neg	neg	neg	pos	neg	neg
18	savithri	37/F	72474	21/12/2011	29/12/2011	108	102	15	1.9	100	5000	136	3.8	24	2	36	NA	emer	nil	JEJ	8	0.70%	8	neg	neg	neg	neg	neg	neg	neg
19	sampathkumar	19/M	46326	11/8/2012	30/8/2012	103	96	15	1.8	99.5	7400	140	4.1	26	1	30	NA	emer	nil	JEJ	13	1.50%	19	pos	neg	neg	neg	pos	neg	neg
20	Vasanthakumar	28/M	29688	27/4/2012	10/5/2012	104	96	15	1.3	103	6300	128	3.4	28	2	36	NA	emer	nil	DUP	15	2.00%	13	neg	neg	pos	neg	neg	neg	neg
21	ramesh	32/M	26236	14/5/2012	20/5/2012	110	106	15	1.5	103	4300	143	3.5	19	2	36	NA	emer	nil	dup	15	2.00%	6	neg	neg	neg	neg	neg	neg	neg
22	jabe	28/M	28051	22/5/2012	28/5/2012	115	104	15	1.4	96.7	4500	132	5.6	24	4	47	NA	emer	nil	dup	15	2.00%	6	neg	neg	neg	neg	neg	neg	neg
23	manikandan	48/M	32238	5/6/2012	13/6/2012	106	112	15	1.8	102	7200	140	3.9	21	2	40	NA	emer	nil	dup	15	2.00%	8	neg	neg	neg	neg	neg	neg	neg
24	venkatesh	45/M	33846	12/6/2012	22/6/2012	101	108	15	1.6	95.6	6700	136	4.1	23	2	38	NA	emer	nil	dup	15	2.00%	8	neg	neg	neg	neg	pos	neg	neg
25	saraswathi	51/F	34154	13/6/2012	21/6/2012	109	110	15	1.9	99	6850	139	4.6	24	3	44	NA	emer	nil	DUP	15	2.00%	8	neg	neg	neg	neg	neg	neg	neg
26	subramani	40/M	36222	23/6/2012	30/6/2012	96	110	15	1.6	97	8500	139	3.8	21	1	34	NA	emer	nil	DUP	15	2.00%	7	neg	neg	neg	neg	neg	neg	neg
27	velumurugan	25/M	36456	24/6/2012	30/6/2012	110	96	15	1.6	103	7400	138	3.9	26	1	32	NA	emer	nil	DUP	15	2.00%	6	neg	neg	neg	neg	neg	neg	neg
28	chinnaraj	48/M	38750	5/7/2012	14/7/2012	113	110	15	1.1	99.1	4300	130	3.4	23	1	34	NA	emer	nil	DUP	15	2.00%	9	neg	neg	neg	neg	neg	neg	neg
29	paramasiva	50/M	45677	5/8/2012	11/8/2012	108	110	15	1.6	97	5400	137	3.2	24	1	38	NA	emer	nil	DUP	15	2.00%	6	neg	neg	neg	neg	neg	neg	neg
30	perumal	45/M	50409	31/8/2012	9/9/2012	102	120	15	1.7	97.6	4900	138	3.2	27	1	34	NA	emer	nil	DUP	15	2.00%	10	neg	neg	neg	neg	neg	neg	neg
31	rangasamy	45/M	73024	24/12/2011	2/1/2012	102	122	15	1.3	100	4600	132	4.1	32	1	45	NA	emer	nil	DUP	15	2.00%	9	neg	neg	neg	neg	neg	neg	neg
32	prem	30/M	15129	19/3/2012	30/3/2012	135	102	15	1.3	102	8300	139	3.8	17	2	45	NA	emer	nil	Gas	15	2.00%	11	neg	neg	neg	neg	neg	neg	neg
33	nagaraj	40/M	60361	2/10/2012	########	96	110	15	1.3	100	7200	137	3.9	30	1	37	NA	emer	nil	DUP	15	2.00%	8	neg	neg	neg	neg	neg	neg	neg
34	annadurai	44/M	63408	#########	21/10/2012	98	110	15	1.6	101	5400	132	3.4	28	1	34	NA	emer	nil	DUP	15	2.00%	5	neg	neg	neg	neg	neg	neg	neg
35	vimal	17/M	22959	2/5/2012	11/5/2012	101	104	15	1.3	103	5400	124	3.8	29	1	38	NA	emer	nil	ILEAL	16	2.30%	9	neg	neg	neg	neg	neg	neg	neg
36	perumal	30/M	26169	9/5/2012	16/5/2012	110	96	15	1.3	101	5600	138	3.1	18	3	48	NA	emer	nil	JEJ	16	2.30%	7	neg	neg	neg	neg	neg	neg	neg
37	Adheesh	28/M	37411	28/6/2012	8/7/20212	112	96	15	0.9	101	7200	141	3.4	27	1	36	NA	emer	nil	DUP	17	2.60%	10	neg	neg	neg	neg	neg	neg	neg
38	Ibrahim	37/M	16447	25/03/2012	8/4/2012	110	90	13	1	99	6000	135	3.9	20	3	62	NA	emer	nil	JEJ	18	2.90%	13	neg	neg	pos	neg	pos	neg	neg

Appendix-3

MASTER CHART

39	Rajammal	50/M	19759	8/4/2012	16/4/2012	100	108	15	1.2	103	9500	135	3.8	21	3	27	NA	emer	nil	DUP	18	2.90%	8	neg	neg	neg	neg	neg	neg	neg
40	Anbalagan	25/M	20254	10/4/2012	16/4/2012	128	100	15	1.4	101	5500	136	3.8	25	2	64	NA	emer	nil	JEJ	18	2.90%	6	neg	neg	neg	neg	neg	neg	neg
41	Nanjundan	55/M	23910	1/5/2012	14/5/2012	100	110	15	1.7	97	5900	129	3.9	16	2	36	NA	emer	nil	ILEAL	18	2.90%	13	neg	neg	pos	neg	neg	neg	neg
42	murugan	45/M	21165	9/5/2012	19/5/2012	105	106	15	1.4	101	4200	126	5.6	21	1	49	NA	emer	nil	JEJ	18	2.90%	10	neg	neg	neg	neg	neg	neg	neg
43	kumar	20/M	30673	29/5/2012	8/6/2012	129	108	15	1.6	98.6	12100	140	2.8	19	3	43	NA	emer	nil	jej	18	2.90%	10	neg	neg	neg	neg	neg	neg	neg
44	vishwalingam	55/M	31137	4/6/2012	13/6/2012	106	110	15	1.5	103	11000	144	3.8	27	2	44	NA	emer	nil	dup	18	2.90%	9	neg	neg	neg	neg	neg	neg	neg
45	suresh	26/M	35469	19/6/2012	25/6/2012	118	90	15	1	99	7300	120	3.4	22	2	28	NA	emer	nil	DUP	18	2.90%	6	neg	neg	neg	neg	neg	neg	neg
46	vellingiri	50/M	37302	27/6/2012	8/7/2012	102	110	15	1.8	104	6300	140	3.2	28	1	38	NA	emer	nil	DUP	18	2.90%	11	neg	neg	neg	neg	neg	neg	neg
47	jodhakumar	35/M	43413	27/7/2012	6/8/2012	115	96	15	0.9	99.2	8500	150	3.9	26	1	38	NA	emer	nil	DUP	18	2.90%	9	neg	neg	neg	neg	neg	neg	neg
48	elamurugan	28/M	26075	9/5/2012	18/5/2012	110	108	15	1.2	103	9500	146	3.8	19	3	38	NA	emer	nil	JEJ	19	3.30%	9	neg	neg	neg	neg	neg	neg	neg
49	shivananjan	48/M	21164	9/5/2012	19/5/2012	100	110	15	0.9	97.3	5700	138	4	30	2	34	NA	emer	nil	DUP	19	3.30%	10	neg	neg	neg	neg	neg	neg	neg
50	kanddan	32/F	34003	13/6/2012	25/6/2012	108	94	15	1.9	98	7600	143	2.9	19	1	45	NA	emer	nil	DUP	19	3.30%	12	neg	neg	neg	neg	pos	neg	neg
51	vijay	50/M	53771	20/9/2011	1/10/2011	117	100	15	0.9	99.2	7200	140	4.1	22	1	53	NA	emer	nil	Gas	19	3.30%	11	neg	neg	neg	neg	neg	neg	neg
52	Subbamma	65/F	16358	24/03/2012	4/4/2012	100	100	15	1.5	100	8000	140	4	23	2	26	NA	emer	nil	DUP	20	3.70%	10	neg	neg	neg	neg	neg	neg	neg
53	Masanam	40/M	23307	25/4/2012	3/5/2012	90	100	15	1.4	100	6800	120	4.8	21	2	40	NA	emer	nil	DUP	20	3.70%	8	neg	neg	neg	neg	neg	neg	neg
54	kannan	25/M	33248	10/6/2012	21/6/2012	115	120	15	2	104	6100	144	2.5	14	3	43	NA	emer	nil	ileal	20	3.70%	11	neg	neg	pos	neg	neg	neg	neg
55	pattammal	65/F	33452	11/6/2012	20/6/2012	110	116	15	1.3	101	6400	142	3.6	27	1	52	NA	emer	nil	dup	20	3.70%	9	neg	neg	neg	neg	neg	neg	neg
56	manikandan	36/M	42603	24/7/2012	10/8/2012	110	90	15	0.8	96.4	7900	143	5.2	23	1	48	NA	emer	nil	ILEAL	20	3.70%	16	neg	neg	pos	neg	pos	neg	neg
57	palanisamy	64/M	48365	21/8/2012	30/8/2012	93	130	15	1.7	101	4100	136	3.4	27	1	47	NA	emer	nil	DUP	20	3.70%	9	neg	neg	neg	neg	neg	neg	neg
58	palaniammal	60/F	49632	27/8/2012	6/9/2012	95	118	15	1.6	97	3400	132	3.5	24	2	39	NA	emer	nil	DUP	20	3.70%	9	neg	neg	neg	neg	neg	neg	neg
59	raman	60/M	52191	7/9/2012	18/9/2012	102	140	15	1.5	99	6000	142	4	32	1	45	NA	emer	nil	DUP	20	3.70%	11	neg	neg	pos	neg	neg	neg	neg
60	armugam	60/M	4507	26/1/2012	3/2/2012	94	130	15	1.6	101	9000	137	3.8	29	1	32	NA	emer	nil	dUP	20	3.70%	7	neg	neg	neg	neg	neg	neg	neg
61	rajkumar	48/M	5956	1/2/2012	12/2/2012	117	94	15	1.8	102	8400	148	4.8	23	1	35	NA	emer	nil	Gas	20	3.70%	11	neg	neg	neg	neg	pos	neg	neg
62	gandhi	45/M	51608	12/9/2011	25/9/2011	108	96	15	1.3	101	7300	140	3.9	29	1	36	NA	emer	nil	Gas	20	3.70%	13	pos	neg	neg	neg	neg	neg	neg
63	Nataraj	70/M	43090	6/8/2012	11/8/2012	90	130	15	1.3	97.8	4900	137	3.8	28	1	48	NA	emer	nil	DUP	23	5.20%	5	neg	neg	neg	neg	neg	neg	neg
64	rajendra	48/M	26322	14/5/2012	1/6/2012	118	96	15	1	99.4	5900	141	3.2	25	1	50	NA	emer	nil	ileal	24	5.80%	17	pos	neg	neg	neg	neg	neg	neg
65	shanmugam	49/M	28799	25/5/2012	15/6/2012	110	140	14	1.4	97.3	7300	128	5.2	28	3	65	NA	emer	nil	flank	24	5.80%	20	pos	neg	pos	pos	neg	neg	neg
66	devendran	75/M	7000	7/2/2012	21/2/2012	90	130	15	1.5	100	6300	138	3.6	28	2	56	NA	emer	nil	DUP	24	5.80%	14	neg	neg	neg	neg	pos	neg	neg
67	Aiappan	48/M	18611	2/4/2012	16/4/2012	100	96	15	1	98.3	12000	145	3.7	20	3	68	NA	emer	nil	JEJ	25	6.50%	14	pos	neg	neg	neg	neg	neg	neg
68	palanisamy	65/M	45070	5/8/2012	19/8/2012	114	84	15	1	98	8700	138	3.4	25	2	56	NA	emer	nil	flank	25	6.50%	14	neg	neg	neg	neg	neg	neg	neg
69	manoharan	51/M	53127	20/9/2011	3/10/2011	127	106	15	1.5	98.6	6300	138	3.7	27	2	79	NA	emer	nil	DUP	25	6.50%	13	neg	neg	neg	neg	pos	neg	neg
70	Muthusamy	88/m	20749	12/4/2012	21/4/2012	90	130	15	2	100	6300	138	4.2	24	2	50	NA	emer	nil	JEJ	26	7.20%	9	neg	neg	neg	neg	neg	neg	neg
71	kindan	20/M	26547	11/5/2012	26/5/2012	128	70	15	1	100	5600	146	4.5	23	5	41	NA	emer	nil	ILEAL	26	7.20%	15	neg	neg	neg	neg	neg	neg	neg
72	meghanath	50/M	33769	13/6/2012	29/6/2012	117	96	15	1.8	98	4300	135	3.3	28	3	65	NA	emer	nil	dup	26	7.20%	16	neg	neg	pos	neg	neg	neg	neg
73	selvaraj	56/M	42205	23/7/2012	9/8/2012	110	96	15	1.4	98	5900	140	2.5	19	1	40	NA	emer	nil	DUP	26	7.20%	16	pos	neg	neg	neg	neg	neg	neg
74	ramasamy	80/M	11403	19/2/2012	6/3/2012	90	130	15	1.2	98.3	4600	140	3.8	29	1	56	NA	emer	nil	DUP	26	7.20%	7	neg	neg	neg	neg	neg	neg	neg
75	kumar	50/M	14290	14/3/2012	28/3/2012	110	96	15	1.9	98	6300	128	3.8	23	1	67	NA	emer	nil	DUP	26	7.20%	14	pos	neg	neg	neg	neg	neg	neg
76	chinnaraj	65/M	37988	4/7/2012	21/7/2012	100	110	15	1.9	98.3	4700	136	3.4	25	1	66	NA	emer	nil	DUP	26	7.20%	17	pos	neg	neg	neg	neg	neg	neg
77	Mahendran	25/M	17345	30/03/2012	2/4/2012	122	80	15	0.8	97	7250	140	3.5	21	2	73	NA	emer	nil	JEJ	28	8.80%	leatl	neg	neg	neg	neg	neg	neg	neg
78	Mahalingam	45/M	24017	29/4/2012	21/5/2012	100	108	15	1.9	98	7200	147	2.9	19	3	63	NA	emer	nil	GAS	28	8.80%	22	pos	neg	pos	neg	neg	neg	neg
79	kannan	28/M	25182	6/5/2012	4/6/2012	126	100	15	0.9	101	8300	140	5.4	17	3	68	NA	emer	nil	GAS	28	8.80%	28	pos	neg	pos	neg	neg	pos	pos
80	thirumurugan	28/M	38511	3/7/2012	24/7/2012	116	90	15	1.6	99.3	9300	144	4.8	14	3	56	140	emer	nil	jej	28	8.80%	21	pos	neg	neg	pos	pos	neg	neg
81	vasu	38/M	65858	19/11/2011	5/12/2012	133	90	15	1.2	100	4800	133	3.4	27	2	46	95	emer	nil	DUP	28	8.80%	16	pos	neg	neg	neg	neg	neg	neg
82	abdulla	40/M	38003	2/7/2012	22/7/2012	130	64	15	0.8	96	9500	138	4.6	21	2	55	NA	emer	nil	flank	29	9.70%	20	pos	neg	pos	pos	neg	neg	neg

Appendix-3

MASTER CHART

83	rajan	67/M	46415	13/8/2012	20/8/2012	118	78	15	0.8	98.3	7300	130	4.6	23	2	48	NA	emer	nil	flank	29	9.70%	7	neg	neg	neg	neg	neg	neg	neg
84	Malik	21/M	24386	1/5/2012	1/6/2012	120	90	15	0.6	95	7900	120	3.2	20	4	35	NA	emer	nil	JEJ	30	######	30	pos	pos	neg	pos	neg	pos	pos
85	annadurai	50/M	65953	25/10/2012	2/11/2012	113	96	15	1.4	104	4800	146	4.1	23	1	70	NA	emer	nil	JEJ	30	######	7	neg	neg	neg	neg	neg	neg	neg
86	Nataraj	65/M	18002	31/03/2012	21/4/2012	120	86	15	0.7	98	8300	148	5.8	16	4	75	NA	emer	nil	Gas	38	######	leatl	pos	pos	neg	neg	neg	pos	pos
87	paramasiva	39/M	21554	17/4/2012	20/4/2012	115	86	14	1	103	10200	130	4.2	18	5	60	130	emer	nil	DUP	38	######	leatl	neg	neg	pos	neg	neg	neg	neg
88	rajendra	45/M	28418	23/5/2012	24/5/2012	127	96	13	0.9	98.3	6200	120	4.9	21	3	58	NA	emer	nil	dup	38	######	leatl	neg	neg	pos	neg	neg	neg	neg
89	govinda	53/M	60833	25/10/2011	16/11/2011	110	96	15	0.8	101	6100	146	3.8	19	4	78	NA	emer	nil	JEJ	38	######	leatl	pos	pos	neg	neg	neg	pos	pos
90	ammaniammal	66/F	76022	14/12/2011	16/12/2011	118	86	15	1	101	8300	145	5.2	18	1	70	NA	emer	nil	GAS	38	######	leatl	neg	neg	neg	neg	neg	neg	neg
91	Thirumoorthy	55/M	19395	7/4/2012	14/4/2012	124	94	15	0.7	96	10700	135	3.9	19	4	68	NA	emer	nil	DUP	41	######	leatl	neg	neg	pos	neg	neg	neg	neg
92	Ram Babu	20/M	20056	13/4/2012	14/4/2012	110	86	15	0.6	100	18000	136	4.3	21	3	78	100	emer	ympl	COL	42	######	leatl	neg	neg	pos	neg	neg	neg	neg
93	valliammal	75/F	39384	9/7/2012	10/7/2012	103	60	12	1	97	7200	146	4.8	20	3	57	NA	emer	nil	ILEAL	43	######	leatl	neg	neg	neg	neg	neg	neg	neg
94	perumalsamy	50/M	70992	14-12-12	14-12-12	140	84	15	0.4	101	11200	118	5.3	21	1	56	NA	emer	nil	DUP	43	######	leatl	neg	neg	neg	neg	neg	neg	neg
95	rangaraj	26/M	73579	27/12/2011	29/12/2011	136	80	12	0.6	96.8	6000	120	2.3	26	5	78	NA	emer	nil	JEJ	44	######	leatl	neg	neg	neg	neg	neg	neg	neg
96	murugan	45/M	38370	23/6/2012	2/7/2012	122	68	12	0.8	98	8800	145	4.8	19	1	56	NA	emer	nil	DUP	45	######	leatl	neg	neg	pos	neg	neg	neg	neg
97	murugeshan	39/M	43415	27/7/2012	13/8/2012	117	80	15	0.7	97	2600	120	4.3	16	4	56	NA	emer	AIDS	ILEAL	46	######	21	pos	pos	neg	neg	neg	pos	pos
98	murugeshan	50/M	27662	19/5/2012	19/5/2012	127	68	15	1.2	101	2100	132	3.1	14	4	46	96	emer	nil	COL	48	######	leatl	neg	neg	pos	neg	neg	neg	neg
99	lingappan	80/M	6536	4/2/2012	8/2/2012	113	90	15	1	101	3200	136	3.4	20	1	78	90	emer	nil	DUP	48	######	leatl	neg	neg	pos	neg	neg	neg	neg
100	meghanath	34/M	28397	29/5/2012	3/6/2012	145	86	15	0.8	96.2	2400	122	3.2	14	3	57	NA	emer	AIDS	JEJ	49	######	leatl	pos	neg	pos	neg	pos	neg	neg

LEGENDS

DOA- Date of Admission; DOD- Date of Discharge; BP- Blood pressure; GCS- Glascow coma scale; WBC- White Blood Cells; S. Na- Serum Sodium; S.K- Serum Potassium; S.HCO3- Serum Bicarbonates; S. BILI- Serum Bilirubin; S. Urea- Serum Urea; CPAP- Continuous Positive Airway Pressure; FiO2- Fractional Inhaled Oxygen; DUP- Duodenal of Perforation; JEJ- Jejunal Perforation; ILEAL- Ileal perforation; GAS- Gastric Perforation; COL- Colonic Perforation; flank- Flank Drain; SAPS II- Simplified Acute Physiological Scoring II; stay- Hospital Stay; resp comp- Respiratory Complications; intra abd abs- Intra Abdominal Abscess; neg- negative; pos- positive; NA- not applicable; emer- Emergency Surgery; UTI- Urinary Tract Infection; re lap- Relaparotomy; ent cut fist- Enterocutaneous Fistula.